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Mount Erebus, an active volcano, within the antarctic zone, appears in the background. To the right is part of an iceberg which was frozen fast before it had time to drift out to sea.

ONE OF A SERIES OF MOVING PICTURES OF THE SCOTT ANTARCTIC EXPEDITION.—[See page 560.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Need of an Automatic Stop

FATE seems to have singled out the New York, New Haven and Hartford Railroad Company to teach the need of an automatic train stop. In the course of the last two years—from June 8th, 1911, to June 12th, 1913—there have been no less than thirteen accidents on that unfortunate road—thirteen accidents in which forty-eight persons were killed and hundreds injured. The sheer carelessness of engineers was responsible for part of this loss of life, and spreading rails, short crossovers, inoperative signals and other defective equipment for the rest. The last accident, a rear-end collision in which six were killed, was also primarily due to defective equipment.

In his testimony at the Coroner's inquest, the engineer who is held responsible told a story which, if substantiated, absolves him of carelessness. Absolutely unfit though he was to drive a fast passenger locomotive—he was a promoted fireman who had handled a powerful express engine only a few times—he had been placed in the cab of a new and exceptionally heavy Pacific-type engine the airbrakes of which had been reported defective. He testified that he obeyed both the distant and the home signals set against him before he reached the scene of the accident, by shutting off his steam and applying his airbrakes. Either because the airbrake equipment was not adapted to this 200,000-pound locomotive and the eight cars behind it or because it was out of order, the train rushed on. The engineer sanded the track, blew his whistle, and finally tried to reverse his power, but was unable to do so because of his physical inability to move the stiff reversing lever sufficiently. The brakes of the rear cars apparently held better than those of the forward cars.

Something can be learned from this disaster. Engine builders must obviously provide a more easily operated reversing gear. Passing over the fact that the airbrakes seem to have unaccountably failed and that instead of a steel coach, a wooden parlor car had to bear the brunt of the shock, with the familiar results on which we have repeatedly commented, again the necessity of relying on an automatic apparatus, which will act independently of an engineer, is driven home with tragic force.

No doubt the New Haven road's interest in automatic stops, evidenced by its widely advertised ten thousand dollar offer for a suitable appliance, will be heightened by this latest catastrophe. The railroad as well as inventors in general will surely profit by a close study of the circumstances that occasioned the collision. We must admit that we know of no automatic stop, otherwise unobjectionable, which would have averted this particular collision, for the reason that most stops do not shut off the power, but simply act on the airbrake system and sound or display a signal. Only a stop which would reverse the power would be of any service when airbrakes prove inoperative at the crucial moment.

Agriculture in the High Schools

THE plan of teaching agriculture in the secondary schools is spreading over the country with remarkable rapidity—so much so, in fact, that it is very difficult to find enough teachers qualified to give such instruction, to say nothing of the lack of suitable equipment and other material difficulties. Agricultural colleges are now a familiar institution, and agricultural instruction in the common schools is no novelty. On the other hand, agriculture in the high schools may still be regarded as experimental, though it will soon cease to be so. This subject has just been investigated and reported upon by the United States Bureau of Education. From the report in question it appears that as recently as the school year 1906-07 less than one hundred public secondary schools, either special or general, gave agricultural instruction, even by means of simple experiments. In 1910 about 1,800 schools reported that agriculture was taught as a separate study in the high-school department. It is true that in some of these cases the term "high school" was made to include the upper grades of the grammar school; but even making allowance for this fact, it remains evident that there has been an immense increase in the number of true high schools in which distinct courses in agriculture are offered.

The first tentative steps in this direction date from the period between 1825 and 1860, during which there were a few attempts to introduce agricultural instruction into the ordinary academies, as well as some purely vocational experiments. From 1865 down to a very recent date the land-grant colleges, established under the famous Morrill act of 1862, in addition to their regular college courses, did much work of a purely secondary school grade. The University of Minnesota in 1898 set off this work into a high school department, an example very largely followed since. About 1907-08 a large number of special agricultural high schools were established; but this practice has now declined somewhat in favor of the plan of granting State aid for the support of departments of agriculture, or of agriculture and home economics, sometimes including manual training, in high schools already in existence.

Another token of progress is the increasing length of these high school courses in agriculture, which at the outset were mainly limited to one year. In the academic year 1911 to 1912 agricultural courses of two or more years were maintained locally in about 135 public schools, and by State aid in 175 more. This is in addition to 50 or more separate special schools of agriculture and 34 secondary schools attached to the land-grant colleges.

Lack of teachers has been the great difficulty ever since the introduction of special agricultural courses into the high schools began. When the textbook was supplemented by simple school-room experiments, a short summer course was sufficient to piece out the general training of the science teacher, or the practical farm experience of the principal or superintendent. Now, however, with high school courses extending over several years, and including the more elaborate field and judging operations, such meager training is inadequate. Within the last two or three years the idea has spread rapidly of establishing professorships of education in agricultural colleges, and professorships of agriculture in colleges of education (the general normal schools). Moreover, there are now greatly improved facilities for preparing instructors for high school agriculture in at least 37 of the land-grant colleges, thanks chiefly to the so-called "Nelson amendment" to the agricultural appropriation bill approved March 4th, 1907, which provides that a portion of the funds appropriated thereby, amounting now to $25,000 annually, may be used by the land-grant colleges for the special preparation of instructors for teaching the elements of agriculture and mechanic arts.

The textbook problem has been fully solved during the past three years, with the appearance of texts especially written for secondary schools, including some on particular branches of agriculture for use in the advanced courses.

An Optical Test for Mechanical Strains

THE modern engineer has a wide field from which to choose in devising methods of testing materials: the physicist is ready to place in his hands the most refined means of experimental observation. Thus, for example, it may often be sufficient to know the net result, as measured at the points of application, of a system of stresses exerted on a given structure or machine part. But how much more valuable the knowledge gained if we can actually look into the very core of the material of construction, and *see* the lines of strain. A simple application of physical principles enables us to do this. For a transparent body, such as glass, under strain, no longer allows the passage of light indifferently in all directions. It becomes "optically active," as the physicist says, and rotates the plane of polarized light in a measure depending upon the magnitude of the strain. The effect can be rendered observable to the eye by the aid of a Nicol's prism. In this way a glass model of a structure or sample to be tested gives us a valuable insight into the distribution of strains, primarily in the model, and, by inference, in the material itself. It is true that the properties of glass will differ more or less widely from those of the materials actually employed in construction. While this will affect the results in their quantitative relation, they remain true qualitatively.

A series of tests of this character has been performed by Prof. E. G. Coker of the City and Guilds of London Technical College, and was reported upon before the sixth congress of the International Association for Testing Materials. An account of these experiments will be found in this week's issue of our SUPPLEMENT. Prof. Coker applied the method in particular to the examination of cement briquettes such as are employed in the usual strength tests. He shows that the ratio of maximum stress to mean stress varies from 1.70 for the American standard to 1.75 for the English and 1.95 for the continental standards, respectively. These measurements indicate the want of agreement in the stress distribution in the several standard types; and show what an important factor the form of the briquette is. This is just one application of a method which seems destined to find a very general field of utility.

Genetic Research in Great Britain

WRITING of "The Progress of Mendelian Studies in Great Britain," in the *Monthly Bulletin of Agricultural Intelligence* of the International Institute of Agriculture, Prof. R. C. Punnett of Cambridge University shows how intense the activity has become in this comparatively new field, and what valuable results have already been achieved by British investigators. It happened that the well-known work of Bateson and his colleagues, at Cambridge, coincided with the rapid rise of the School of Agriculture of the University, so that the new knowledge was immediately applied to practical purposes, especially in Prof. Biffen's experiments in crossing cereals. Already improved wheats have been developed and placed at the service of British farmers. The British government now subsidizes the researches in plant-breeding at Cambridge, which have been extended to plants other than cereals; especially fruit trees. One important undertaking in progress here is the development of a potato naturally immune from *Phytophthora infestans* (potato blight), and success appears to be near at hand. The Cambridge experiments also extend to poultry and sheep. The best equipped British institution for the study of genetics is now the John Innes Horticultural Institution at Merton, near London, started in 1909 with Prof. Bateson, formerly of Cambridge, as its first director. Mr. Hurst, one of the pioneers in Mendelian studies, has established an experimental station at Burbage, near Leicester, where one of the most interesting experiments aims at the production of a pure race of steeplechasers; i. e., horses with a special aptitude for hunting. Genetic research is also carried on by Prof. Keeble, at University College, Reading, especially on primulas; by Mr. Staples-Browne, of Bampton, near Oxford, who is working with pigeons; and by Dr. Trow of Cardiff. In Ireland, Prof. Wilson of Dublin has lately brought together a number of records dealing with the heredity of coat-color in cattle and horses, and with the milking capacity of cows. Scotland has made a start by creating a lectureship in genetics at the University of Edinburgh.

Investigating Atmospheric Pollution

A COMMITTEE has been formed with headquarters at London, for the purpose of standardizing and co-ordinating the diverse methods in use in various parts of Great Britain for determining the degree of pollution of the atmosphere by dust and soot.

Undertakings of this character include the investigations conducted by the *Lancet* in 1911 upon the soot-fall of London; Prof. Cohen's experiments at Leeds; and those of the Glasgow Corporation. Heretofore no attempts have been made to introduce uniform methods, so that the measurements made in different places are not comparable. The committee has now decided to recommend two methods.

One of these methods is that successfully used in the inquiry conducted by the *Lancet*, in which a form of enlarged rain-gage having a catchment area of four square feet received all rain, soot, and other deposits, and in which a large bottle was provided to collect them, so that they could be analyzed each month and the amount of solids estimated.

In the second method, which is much more complicated than the first, a measured volume of air is drawn through filter paper in a special apparatus, and the degree of discoloration of the paper measured. This method, which has been in use in Glasgow for about two years, is intended to give measurements of the solid contents of the air from day to day, and from hour to hour.

Engineering

Investigating Railroad Accidents.—A careful study of all accidents, no matter what their nature, has been made by the Pennsylvania Railroad, during the past year, and it has been found that probably 75 per cent of them could have been prevented if the employees had exercised special caution. This has led to the publication of a booklet entitled "Safety Hints and Suggestion for the Prevention of Personal Injury Accidents," by which it is hoped to educate the employees to a disposition to be careful, and to develop in each individual a sense of personal responsibility, not only for his own safety, but for that of his fellow employee as well.

Largest Diesel Engined Vessel.—The ship "Hagen" which is the largest vessel in the world to be propelled by Diesel oil engines, recently made her trial trip in the lower New York Bay. The vessel which was built for the Standard Oil Company measures 400 feet over all and has a displacement of 8,350 tons. She is equipped with two 6-cylinder Diesel engines of 2-cycle type, adapted to develop 2,400 horse-power at 140 revolutions per minute. At sea the steering engine is driven by compressed air. When nearing port, steam from a donkey boiler is used in the steering engine. The vessel is lighted by electricity and the living quarters are heated by a hot-water system, the water being heated by the main exhaust of the engine. During the test the vessel ran at about eleven knots.

Death of Charles Henry Cramp.—The former head of the shipbuilding firm of Wi liam Cramp & Sons died at the home of his son in Philadelphia, on June 6th, at the age of 85. He was the son of William Cramp, who founded the firm of William Cramp & Sons on the Delaware in 1830. Upon the death of William Cramp in 1879, Charles Henry Cramp became the head of the firm. He did much toward the building of the American navy. As far back as 1879, he built four vessels for the Russian navy. The battleship "Maine," successor to the "Maine" that was destroyed in Havana Harbor, was built by the Cramps in 1902. It was Mr. Charles H. Cramp who suggested the "penalty system" by which a certain sum is deducted for every unit of power below that guaranteed in the contract. William C. Whitney, then Secretary of the Navy, accepted this suggestion and also introduced a premium system by which certain sums are paid in addition to the contract price if the performance exceeds the guarantee in the contract.

Air Testing in Submarines.—In order to determine the amount of carbonic-acid gas in the air of submarines, a device has been developed in Germany known as the "aeronome." It consists of a cylinder of nutwood about 4 inches in diameter and 4 inches high. It carries a scale for the liquid in a U-shaped glass tube which indicates the carbonic-acid content of the air. The cylinder is closed by an air-tight lid. Through the lid passes a thin tube with locking wheel which transmits to the outside air the air tension produced on closing the cylinder. The nickel-plated inside wall and bottom of the cylinder are lined with moist-filter paper. The air within the cylinder which is to be tested communicates with one branch of the U-tube while the other is open to the outside air. In the lid of the cylinder is placed a cartridge for absorbing carbonic acid. This cartridge remains closed while the apparatus is opened to admit the atmosphere that is to be tested, then by screwing down the locking wheel above referred to, the cartridge is made to fall from the lid to the bottom of the chamber, and as it absorbs the carbonic-acid gas, the volume of air in the chambers is reduced by an amount which is indicated in the U-tube. A single cartridge may be used for ten ordinary air tests.

Air Resistance in Simplon Tunnel.—The question of air resistance in the Simplon Tunnel is discussed by a leading Swiss engineer, B. Kilchenmann. The energy required to run trains in the tunnel upon the electric line is 35 watt-hours per ton-kilometer, including the weight of the locomotive, and this high figure is due to air resistance within the tunnel. The tunnel is 14.7 feet wide at the rail level and 18 feet high from ties to roof, the area of section being 250 square feet. The two large electric motor-driven blast fans at the Brigue end send in 3,530 cubic feet of air per second, and there are two corresponding exhaust fans at Iselle. A train allowed to run down the road by gravity on the 7 per 1,000 maximum gradient between the tunnel ends cannot exceed a speed of 60 kilometers (37 miles) an hour, even when going in the same direction as the air current, for the action here resembles that of a dash-pot. He compares the results obtained within the tunnel with those of the train when run in the open air, and finds that at a speed of 25 kilometers (15.5 miles) an hour a train running in the tunnel with the air draught encounters less resistance than in the open air, being propelled by the air current. At speeds over this amount, the resistance in the tunnel is greater than in free air. Such resistance due to air will certainly be lessened when the second and parallel tunnel comes to be built, for the pressure will then be balanced between the two ends of the train, as the tunnels will be 55 feet apart on axes and have numerous cross galleries.

Electricity

Long Distance Wireless Telephony.—According to a press report wireless telephonic communications have successfully been established between Berlin and Vienna, a distance of 355 miles. The German station was at Nauen and the Austrian station on the roof of the Technological Industrial Museum in Vienna.

Wireless Station in the Arctic.—The expedition which will leave New York on July 2nd or 3rd to explore the Arctic continent known as Crocker Land, is to carry with it a powerful wireless telegraph equipment. The generators will be operated by kerosene engines and a Telefunken wireless system will be employed, having a range of 2,000 miles. The wireless apparatus will be installed on the north side of Flagler Bay. This will enable the expedition to keep in touch with civilization and it will also permit of experiments with directed Hertzian waves under the ideal climatic conditions of the Arctic. At Flagler Bay there will also be established a seismographic station.

The Output of Electrical Steel.—The Comité des Forges de France has compiled the following table of the world's output of electrical steel:

	1909. Tons.	1910. Tons.	1911. Tons.
Germany and Luxemburg	17,773	36,188	60,654
Austria-Hungary	9,048	20,028	22,867
United States	13,762	52,141	29,105
France	6,515	13,445	13,850
Sweden	591	431	2,034
Total	47,689	122,233	128,510

It will be observed that in all the countries there has been a steady increase in output except in the United States where the output for 1911 is 44 per cent less than that of 1910.

The New Electric Searchlight Projectors, made by the Allgemeine establishment of Berlin, are among the most powerful yet to be produced, and their candle-power, which is too high for measurement, can only be reckoned in hundreds of millions. What is striking is the new method of regulating the arc. The large carbons are now moved back and forth by small electric motors and suitable gears, current being applied to the motors by a set of relays which work according to the current taken by the arc, thus securing an automatic adjustment of the arc length in the best way. The base of the projector contains other motors for all the searchlight movements, and a distant lever control is so designed that turning the lever in all directions makes the projector also follow these same directions for pointing the beam. These searchlights will carry several miles and still give light enough to read by.

The Vibrating Reed Method of showing the frequency of alternating currents is meeting with much favor at present on account of its simplicity and accurate working. As will be remembered, it consists of a set of say ten small tongues of spring steel mounted in line before a long magnet carrying the current, each being tuned for a different pitch between 45 and 55 per second. Only one tongue can vibrate for any given pitch of the current, and the free and slightly upturned end of the reed expands out in an apparent broad line so as to be clearly seen when it vibrates. All the reed ends are on a dial in a line numbered in series so that when the current is at the standard rate of 50, for instance, this numbered reed is seen to vibrate. By using the reeds to make battery contacts, we can signal any over or under frequencies to a distant point. Another use is to mount the new Hiltebrand dial or recorder device over an office desk, connected by wire to the dynamos, so that the chief engineer sees just how the machines are running.

Electric Heat-storage Stove.—Perhaps the development of electrical cooking has not been greatly encouraged for the reason that such apparatus would be employed at the very time when the load of the central station was highest. Recently an electrical stove has been invented which the central station manager should welcome for the very reason that it calls for a low rate of current continuously or during the period when the central station is not burdened with a peak load. The stove consists of a block of iron imbedded in heat insulating material. Within this block is an electrical heating unit. The surface of the iron block forms a smooth plate on which a cooking utensil may be placed. But normally when the stove is not in use it is covered by a lid, also filled with heat insulating material. As there is practically no outlet for the heat generated by the heating unit, the iron block is steadily heated and rises in temperature until the cover is removed for a cooking utensil to be substituted. After one dish has been cooked, the cover is applied to the stove again and it is permitted to store heat until the next dish is to be cooked. As compared with the ordinary disk stove the heat-storage stove uses very little current.

Science

A Remarkable Natural Bridge in the Philippines, recently discovered by Mr. Paul R. Fanning, is described in the *Philippine Journal of Science.* Although only about thirty miles south of Manila, it is believed never to have been visited before by white men, and it is the first large natural bridge reported in the Philippines. It is on the Lucsuhim stream, a couple of miles west of Silang. The stream runs through a cañon, and the space beneath the bridge forms a tunnel, about 35 feet broad and some 250 feet long. The floor of the bridge, now about 130 feet above the stream, bears evidence of having once been the bed of the latter.

Minute X-ray Pictures.—M. Pierre Goby appears to be the first to obtain photographs of very minute specimens by the use of X-rays, such as diatoms and the like which have about the size of a grain of sand. This he does by placing the specimens directly upon a photographic plate and allowing a perfectly vertical beam of the rays to fall from a bulb above, through a special tube so as to properly direct the rays on to the object. In this way he secures a very minute photograph of the interior structure of the specimens, and this can be enlarged many times so as to obtain a large view in which the structure is clearly visible.

Carnation Food.—The mere chemical analysis of a fertilizer does not always afford the proper measure of its benefit to the plant. Nitrogenous manures of various sorts may furnish the same amount of nitrogen and yet produce widely different results with flowers. This has been clearly shown in one of the largest greenhouses in this country where fish guano was tried as a carnation fertilizer with astounding results. In rapidity of growth, strength of stem and beauty of bloom the plants so treated outclassed those fertilized by other manures. Fish scrap is worked up into fertilizer in large quantities along the Middle Atlantic coast and to some extent along the Great Lakes. The cost is not unreasonable. In all probability there is some active plant stimulant in the fish that accounts for the results. Methyl amine is found in fish and this may be the active element.

The Cooling Power of the Atmosphere depends upon other things than its temperature and the temperature of the body cooled. Thus, the wind is an important factor; as is the radiating power of the body in question. Dr. J. R. Milne, of Edinburgh, has described to the Scottish Meteorological Society an instrument for measuring the rate of cooling from a standard surface maintained at a fixed temperature of 98.4 deg. Fahr. This is "blood heat," and appears to have been chosen in order that the readings of the instrument may be a measure of analogous effects upon the human body. The device consists of a cylinder of thin copper, insulated except for its hemispherical top with plaster of Paris. It is filled with paraffin oil, and the amount of electrical energy necessary to keep the oil at blood heat is continuously recorded. Hence may be deduced the loss of heat calories per square centimeter per second. Dr. Milne calls his device the "psuchrainometer." (Why not "psychrainometer"?) It is quite similar in principle to Frankenhauser's "homœotherm" (*Zeitschrift für Balneologie,* vol. 4, 1911, pp. 439-441), as well as to the cruder "depreditometer" of A. Piche and several earlier instruments.

The International Meteorological Committee met in Rome, April 7th to 12th, and was attended by the directors of official meteorology in France, Portugal, Holland, Sweden, Switzerland, Italy, Denmark, Russia, Canada, Prussia, and Great Britain. The questions disposed of included some that have aroused much controversy throughout the meteorological world during the last two or three years. At the request of the International Institute of Agriculture the subject of agricultural meteorology was fully canvassed, and a special commission was appointed to undertake further investigation in this line. Dr. Hergesell, president of the International Commission of Scientific Aeronautics, gave an interesting account of the work recently done in aerology. It is proposed to arrange for a large number of upper-air soundings at far northerly points in 1915 for comparison with those which are to be made by Amundsen during his drift across the north polar basin. In this connection the Russian government will probably carry out upper-air observations at Yakutsk and Verkhoyansk, in Siberia, and will perhaps send aerological expeditions to Nova Zembla and the mouth of the Lena. The German scientific station in Spitsbergen will probably be kept open long enough to co-operate in this undertaking, and it is likely that Stefanssón's Arctic expedition will contribute its part. The much-mooted question of using dynamic units of pressure in meteorology was settled provisionally by the decision to publish the results of aerological observations in both millibars and millimeters. International agreement was finally reached on the question of uniform storm signals; those recommended at the two conferences held in London were adopted, with the exception of the night hurricane signal. The next international meteorological meeting will be a "conference," to be held in 1915, probably in Holland.

Thirty-six Hours Under Water

A Submarine Propelled by Gasoline Engines While Submerged

By Charlton Lawrence Edholm

LAST week the newspapers contained telegraphic dispatches sent directly from a craft at the bottom of Long Beach harbor, California. The vessel was a submarine that was endeavoring to establish a world's record for submergence by staying down thirty-six hours as against the record then held by the "Octopus," which in 1907 remained under water twenty-four hours. The new submarine sank at 11 A. M. on Monday and promptly at 5 P. M. Tuesday rose to the surface with its new endurance record. It contained a crew of six men who were not in the least affected by their long imprisonment. Throughout the test they were able to communicate with the outside world by means of a cable.

The submarine is a 75-foot craft with 7.5-foot beam and weighs 43 tons. It differs materially from the more familiar types, the most striking innovation being the position of the propellers near the bow. It is claimed that by thus pulling instead of pushing the vessel through the water the tendency to dive too abruptly is eliminated.

The inventor is John M. Cage, who has been studying the building of submarines for many years and believes that his model will prove superior in many respects to those now in use. He claims a speed of from seventeen to eighteen knots for his vessel, running submerged, with a maximum speed on the surface of about 16 knots. There are various automatic controls for ventilating, regulating the depth, maintaining stability and steering, but the details of these devices are withheld pending the issue of patents. The nature of some of them may be observed in the photographs, as for instance the rudder, which resembles that of an aeroplane, the projection along the top of the craft resembling the dorsal fin of a fish, etc.

A very important feature is the elimination of storage batteries, as the vessel is operated by gas engines, used during submergence as well as while on the surface. Two gasoline engines are used, each developing 110 horse-power. By a device of unique construction, the exhaust from the engines is expelled from the submarine, while running under water, and an advantage of this system is that greater speed is obtainable while submerged than when running on the surface. Of course the use of gas engines under water necessitates the operation of a device to discharge the exhaust so completely that the air will not be vitiated, and the inventor's tests seem to indicate that he has solved that problem.

An air compressor and flasks for storing up 36,000 cubic feet of air with a pressure of 3,000 pounds form an essential part of the new submarine's equipment.

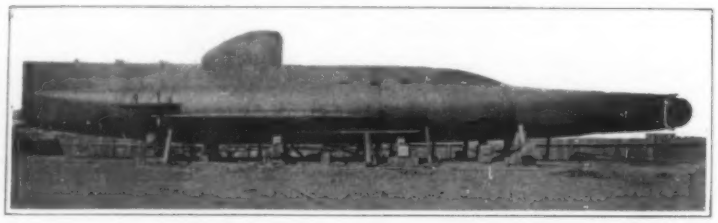
On March 26th a test run was made at Long Beach with the following result: The boat was submerged to a depth of eighteen feet in a thirty-foot depth of water and was found to respond perfectly to her horizontal and vertical rudders, sinking bow first or stern first at will of the inventor, or rising and sinking on even keel. Three men made the initial trip, Mr. Cage, Chief Engineer Allen Hoar and Assistant Engineer Clifford Hauenstein. Later in the day, some newspaper men were taken on a trial trip, and they also reported the success of the engine operations and the purity of the air while they were submerged and the absence of gasoline fumes. Of course no tests for speed were made while in the harbor, but it is believed that records in that line will be made, owing to the novel features in the general outline, position of the propellers and devices for securing maximum power from the engines.

Regarding the feature of elimination of gas fumes, Mr. Cage says: "By our mechanical means, we have run the engines, exhausting overboard against a back pressure of 12½ pounds, all the while maintaining a vacuum on the engine exhaust of 23½ inches. We have also run the engines under water with the valve on the outboard exhaust closed down, until the gage showed a back pressure of 150 pounds, corresponding to a depth of water of over 300 feet, and at that pressure run the engine for thirty minutes, always showing a vacuum of six inches on the engines. This test showed no appreciable load on the engines."

The novel craft was built at a cost of about $70,000, and was constructed partly by the Craig Ship Building Company at Long Beach, and completed in the yard of the Los Angeles Submarine Boat Company.

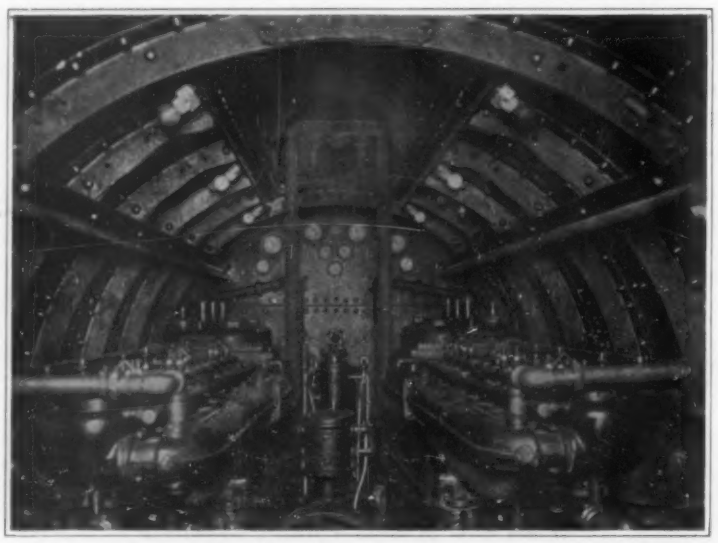
In addition to its value as a war craft, Mr. Cage and his associates believe that there are great commercial possibilities in a vessel designed for the recovery of sunken treasure, and of course records are extant of countless millions of dollars in gold that have been lost in wrecked ships, and in many cases the position of the wrecks is known with sufficient accuracy for a submarine to locate them. Regarding this, the inventor says: "We propose to build a boat capable of being submerged to a depth of 1,000 feet with perfect safety, and with a lifting capacity of 75 tons. With grappling hooks, or clam-shell dredger, and with large and powerful arc lights installed in the bottom of the boat, it would be a feasible undertaking for men within the submarine to work effectively in recovering sunken treasure."

Constructing the hull of the "Cage" submarine.



The completed craft. Note the forward propellers.

Afloat at Long Beach Harbor, California.



The engine room showing the two 110 horse-power gasoline engines.

Human Barometers

MUCH has been written on the relations between weather and disease, and in medical literature there is no lack of carefully drawn curves showing the varying prevalence of particular diseases, the rise and fall of mortality, etc., side by side with others indicating the march of one or more of the meteorological elements. There is, however, one phase of this subject that has been strikingly neglected. Many human beings are notoriously sensitive not merely to the weather of to-day, but also to the weather of to-morrow. Arthritic, rheumatic and neuralgic patients need no barometer or weather map to tell them when bad weather is approaching. Old wounds give trouble at such a time, and members long since amputated reassert their power to cause pain. These phenomena are so well known that it would be sheer fatuity in any scientific man to deny them, merely because he cannot understand them, yet strangely enough they have been the subject of very little systematic investigation.

A special case under this general head is the extreme sensitiveness of some persons to the approach of thunderstorms. The pathological condition experienced by such persons before a thunderstorm must not be confused with ordinary dread of thunder and lightning. In fact, this condition often comes on before there are any ordinary indications of the storm's approach; and the symptoms commonly subside before the storm is over. Attention was called to this condition some years ago by Dr. G. M. Beard, in Beard and Rockwell's "Medical and Surgical Electricity," and it was given the name of "astraphobia." Cases of its occurrence are, however, familiar to almost everybody. The symptoms of the complaint seem to include all kinds of nervous manifestations, going on quite often to extreme nausea, and physical prostration.

One turns naturally to German literature for the elucidation of almost any scientific question that lies off the beaten track, but in this particular case without much satisfaction. It is true that W. Hellpach's unique book "Die geopsychischen Erscheinungen" (Leipzig, 1911) gives quite an elaborate account of astraphobia (without calling it by name), but this work raises many more questions than it answers. Other German writers have dealt with analogous problems. For example, H. von Ficker has attempted to explain the physiological effects often felt before the arrival of the Swiss foehn, as due to the rapid small fluctuations of the barometer. Finally, in the *Zeitschrift für Balneologie* for January 15th and February 1st last, there is a most suggestive article by Dr. Martin Farkas, of Budapest, on "Wetterfühlen." The author has been investigating the aches and pains of the inmates of a home for old soldiers.

However, these questions remain obscure. There is an excellent opportunity here for some original work.

A New Way of Studying Astronomy

The Ingenious Celestial Sphere Invented By Prof. Wallace W. Atwood

Prof. Wallace W. Atwood of the University of Chicago

ON the evening of June 5th, in the museum of the Academy of Sciences in Lincoln Park, Chicago, a large celestial sphere was opened for inspection.

This huge sphere is so constructed that an audience of about fifteen people may enter at one time. After the audience has entered, the door is closed and in a few moments as the eyes become accustomed to the darkness the representation of the stars becomes evident. Little by little, more and more of the familiar stars may be seen until the effect is of a beautiful starlight night.

The instructor on the evening of June 5th was Wallace W. Atwood, the inventor of this apparatus. He used a long black rod tipped with a tiny electric light in the end and pointed out for the convenience of the audience all of the brighter stars and commonly known constellations that were at that time above the horizon.

Then, without anyone realizing it, Prof. Atwood touched an electric switch and caused the sphere to rotate. Other constellations began to appear at the east, pass overhead and set in the west, following paths precisely similar to those followed by the real stars in the real sky.

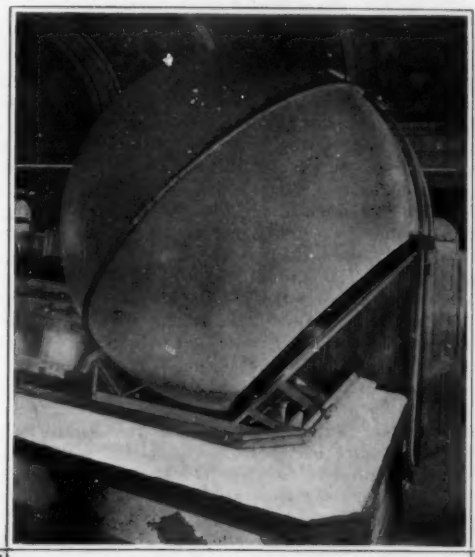
Soon someone observed that the moon was shining and slowly passing to the westward, and that at the appropriate time and at the appropriate place in the eastern horizon the sun appeared. The sun is represented by a small electric light that so illuminates the interior of the sphere that the stars are no longer seen.

The Chicago Academy of Sciences has appreciated the increasing interest in astronomy, and the difficulty which every one meets in trying to become familiar with even the brighter stars and more commonly known constellations. Various plans for promoting this study were considered by the Academy. The flat star charts are confusing to the untrained observer, and the globes, on the outside of which stars are sometimes represented, are unsatisfactory.

Through the use of the Atwood celestial sphere, it is possible to become familiar with all the constellations that are visible in the latitude of Chicago. Few people have had the opportunity of seeing all of these constellations; for on a given evening it is possible to see but a few of them and the apparent motion is so slow that it would take hours and hours of careful watching to see all of those visible on a single perfectly clear night.

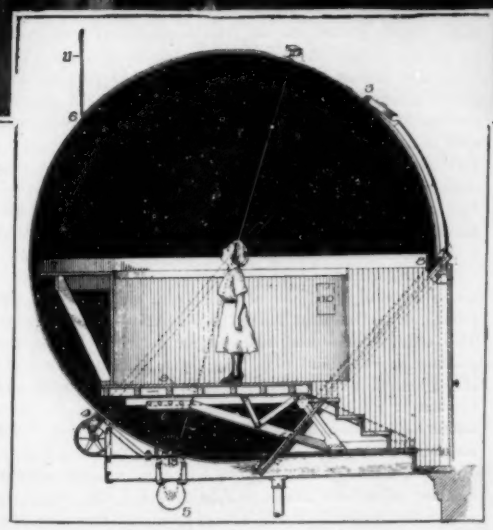
The stars of the first, second, third, fourth and a selected number of those of the fifth magnitude visible from the latitude of Chicago are represented in the sphere, and the total number is 692. In addition to the fixed stars, four planets, Venus, Mars, Jupiter and Saturn, are represented, as well as the sun and the moon. The celestial equator is clearly marked in the interior of the sphere, and the ecliptic, or apparent yearly path of the sun among the stars, is also shown.

Many of the mathematical conceptions necessary for the study of descriptive astronomy, which often discourage the beginner, are made, with this sphere, perfectly simple. There is now no reason why any one, including the younger school children, cannot become familiar with the chief constellations, their apparent movement, the brighter stars and the real and apparent movements of sun, moon, and planets.



Side view of celestial sphere from the west, showing the entrance.

A flashlight of the instructor pointing out the constellations and stars to small children.



North-south cross section of sphere.

1-2. South Polar ring at entrance. 3. Upper wheel supporting sphere. 4. One of two lower wheels which support the sphere and are propelled by motor. 5. Electric motor. 6. North Pole of the heavens. 7-8. Horizon table. 9. Observers' platform. 10. Switch board. 11. Electric wire. 12-13. Ecliptic or the sun's apparent path.

Many of the fundamental ideas in mathematical geography necessary in elementary education are also easily demonstrated with the sphere.

The Atwood sphere now in the Academy building was constructed, installed and presented to the Academy by Mr. LaVerne W. Noyes, president of the Board of Trustees, in order to broaden and promote the educational and scientific work of the Academy.

Construction of the Sphere.

The material used in constructing the sphere is very light galvanized sheet-iron, 1/64 of an inch thick, which has been pressed to the proper curvature and soldered to the equatorial ring and to a much smaller ring about the entrance to the sphere. The separate sheets lap sufficiently to be soldered upon one another. The platform and horizon table are of wood and rest upon a very strong steel frame.

The diameter of the sphere is fifteen feet. The weight, exclusive of the platform, is a little more than 500 pounds. This weight is carried by a 2½-inch tube attached to the outside of the sphere along the line of the equator and resting upon three wheels as shown in the cross section view. The two lower wheels carry the greater portion of the weight, but the third and upper wheel, above the door, resists a certain thrust due to the inclined position of the sphere. The stationary platform within the sphere is supported in part by steel trusses resting upon the framework of the museum balcony, and in part by two upright pillars which rest upon the great I-beam of the main floor of the museum. This platform carries a circular horizon table, below which the sphere is obscured from view, and above which there is a complete hemisphere on which the stars are represented.

The observer in this sphere is located on the surface of the earth at north latitude 41 degrees 50 minutes. Celestial spheres constructed for localities having other latitudes north or south would be placed at other angles and certain other constellations would be represented. Thus a celestial sphere constructed for Buenos Aires, to represent the southern heavens, would be so placed that the observer would enter from the north polar region and see the southern constellations, not visible at Chicago, observe the courses of sun and moon north of him, but fail to see any of the constellations about the North Pole of the heavens as seen from the latitude of Chicago.

Attached to the steel structure supporting the sphere is a small electric motor, which propels the two lower wheels supporting the sphere and their rotation causes the sphere to rotate.

The electric power for rotating the sphere and the light for illuminating the interior are controlled from within the sphere. The electric current necessary for representing the sun is received at the North Pole at a rotary contact, and carried by the insulated wire to the ecliptic, about which there is a wire on the inside of the sphere.

How the Stars, Planets, Sun and Moon are Represented.

The stars are represented by tiny perforations in the sphere. Different sized perforations have been made to represent stars of different magnitudes. The size

and location of each star in the sphere have been determined with great care by using an instrument especially designed for this purpose, so that the sphere is an accurate miniature representation of the heavens.

The shifting positions of the planets Jupiter, Saturn, Mars and Venus among the constellations have been provided for by a number of openings made to represent the different positions of each of these planets at different times of the year. The openings not in use are very readily covered.

The sun is represented by a small electric light which may be moved from place to place along the ecliptic and thus be kept in its appropriate place among the stars. The moon will be represented by a series of small disks cut to represent its various phases and coated with a luminous salt. These disks may be moved from point to point along the orbit of the moon and thus represent that body in its appropriate position in the heavens.

Record Journeys by Aeroplane and Airship

THE cable and wireless last week flashed to America the news of two record trips by lighter-than-air and heavier-than-air craft, respectively, that illustrate how far behind the old world the new world is in the matter of aerial navigation.

The first noteworthy flight, which preceded the other by one day, was made on June 9th by the latest Zeppelin airship "Sachsen" from Baden-Baden to Vienna—a distance of 435 miles—in 8 hours time, or at an average speed of 54 1/3 miles an hour. This huge air-craft, which is fitted with three motors each of 145 horse-power, carried 24 persons on a visit to Emperor Francis Joseph of Austria. Three years ago Count von Zeppelin attempted to visit the Emperor by airship on the occasion of his 80th birthday, but without success. This time, however, he made a perfect flight. Piloting his airship himself, he left Baden-Baden at 3 A. M., and arrived at Vienna at 11—about half the time required by express trains for the journey. Four hundred soldiers assisted at the landing of the huge rigid dirigible on the Aspern Fields. Two hours later a terrific storm swept the parade ground, but fortunately the giant craft was so securely moored that she lived through it without mishap. The next day, in stormy weather, she made her way back to Friedrichshaven safely. The "Sachsen" is the seventeenth Zeppelin airship. She is soon to be stationed at Leipzig, while twenty more are being constructed in addition to the ten at present in service.

The greatest achievement and longest flight of a heavier-than-air machine was that of the brilliant young French aviator, Brindejonc des Moulinais, who covered close to 1,000 miles in 14 1/3 hours elapsed time under terrific weather conditions. He used the same monoplane with which he flew from Bremen to London recently. It is fitted with but an 80 horse-power Gnome motor and made remarkable speed for its power, doubtless on account of a favorable wind.

Starting from Villacoublay at 3:55 A. M., M. des Moulinais made a non-stop flight of some 4½ hours' duration. He landed at Wanne, in Westphalia, in the teeth of a 50-mile gale, and after a stop of 35 minutes resumed his flight to Berlin. He arrived at the Johannisthai aerodrome at 12:04 P. M. (11:04 Paris time), having covered the 575 miles from Paris to Berlin in 6 hours and 34 minutes flying time, or at an average speed of 90 miles an hour. When this daring aviator arrived, there was such a stiff gale blowing that none of the local aviators would risk making flights.

After a 3 1/3-hour rest, although the gale did not decrease, M. Brindejonc for the second time resumed his flight, traveling with the wind toward Warsaw. He covered the 150 miles to Posen in 1 hour and 18 minutes, or at the rate of 112 miles an hour. He left Berlin at 3:37 P. M. and arrived at Warsaw—358 miles distant—at 7:15, requiring but 3 hours and 38 minutes for the non-stop flight and averaging 97½ miles an hour. The total distance of 933 miles had been covered in 10 hours and 12 minutes flying time at an average speed of 91.47 miles an hour as against 27 hours required by the Nord express for the journey. Even the elapsed time was practically one half that of the railroad schedule, while the time in flight from Paris to Berlin was little more than one third of the time required by rail, which is 18 hours.

French Prize Competition in Aviation

THE United States Consul at Sidney, Nova Scotia, referring to the competition to be held in France for $100,000 in prizes for the greatest inventions showing progress in safety in aviation, states an entry will be made from Cape Breton by W. A. MacKay of North Sidney, Nova Scotia, whose invention is a parachute folded in a horizontal position on the tail of a flying machine and harnessed to the aviator and kept folded by strap connection to electro-magnetic releases, which on the pressure of a button open, lifting the aviator out of his seat, so the parachute will become, as expressed by the inventor, the life buoy of the aviator. It is stated that a preliminary test of the invention will shortly be made at the laboratory of Prof. Graham Bell at Baddeck, Nova Scotia.

The True Sandalwood of India

IN the most ancient times the demand for the well-known sandalwood was very great as an incense for the idols. Its use dates back for more than 2,000 years, and all the records bespeak its rarity and costliness; in fact it always was prized more highly than any other wood. But with the advance of civilization new uses and applications opened up by scientific research, at once increased its consumption many fold. This is chiefly for carving and for manufacture of perfumery and medicine. It is obvious that wood with such a wide range of uses is in danger of being exhausted. As in the old days, so now, it is rare and on account of its scarcity very costly. And, unfortunately, sandalwood is rapidly becoming scarcer and more expensive, and the question is asked, How is the production and supply to be maintained proportionate to the demand? The importance of the question is shown by the efforts that are being made in India to cultivate this tree. It is consumed to some extent in India for incense and for wood carving, but a large part of the production is imported into China, where it is highly esteemed as an incense, the Chinese readily paying from two to four times more for the Indian sandalwood than for the less valuable substitutes from the South Sea Islands. The Indian species fully deserves to be designated the sandal tree proper, and the bulk of the sandal oil of commerce is produced from it.

The sandal tree (*Santalum album*) is an evergreen, a member of the sandal tree family. The best known related plant in the United States is the bastard toadflax (*Comandra umbellata*). The term "sandal" or "sander's" wood as was the old English name of it, is probably derived from an East Indian name *chandana* or *sandana*, which is used very generally to indicate various kinds of so-called sandalwoods, and it is quite probable that the name is applied also to other aromatic woods.

The sandal tree is one of the small objects in the forests of India. Even in locations of its best development it attains dimensions that rarely exceeds 40 feet in height and varies from 8 to 12 inches in diameter, or sometimes as much as 15 inches. It is said to have been known to reach 22 inches in diameter at the base, but this can be the case only with very old trees growing in very favored locations. As a rule they are only from 20 to 30 feet in height and from 6 to 8 inches in diameter when they are cut down.

The tree is a native of the mountainous districts of Southern India and is confined mainly to the dry regions. Its finest growth and development is reached in Mysore and Coorg, where the most oily and heavily scented wood is found between 2,000 and 3,000 feet elevation. While it is restricted to comparatively narrow limits the sandal tree has become naturalized in several countries, notably in certain districts in South Africa, where attempts have been made to plant it on a commercial scale.

It will endure a wide range of climatic and soil conditions, especially in protected places, but it will not respond to treatment like the majority of trees desirable for planting for revenue. The tree thrives best in a red or black loam or in fine gravelly soil with free drainage, especially where the soil is rocky. For the production of a large proportion of heartwood which yields the oil, the sandalwood tree must be grown under the most favorable conditions. The trees are seldom found in heavy timber forests, but occur chiefly in light deciduous forests. Flat ground and gentle slopes are preferred and the greatest bulk and height are attained with a moderate heavy rainfall. Rich soil is required for rapid growth, but this does not necessarily add to the oil content of the wood. For most of the uses other than the commercial distillation of the oil, the tree may well be cultivated wherever it can be made to live.

The importance of its cultivation may be urged, inasmuch as every part is of use, from the roots to the young branches that have any heartwood developed. The chief commercial uses of sandalwood is for the extraction of sandal oil. The older, larger roots yield the greatest proportion of sandal oil. In India and Ceylon it is customary to dig up the trees by their roots and distill the oil from stump and root wood as well. The best oil comes almost exclusively from the root wood. The proportion of the valuable scented heartwood is only about one half of the log, while the sapwood has little or no value. Even the fragrant sawdust or powder is used for distilling the sandal oil and sells at the wood depots for from $130 to $165 per ton. Not all the sandalwood is employed for oil, but with its yellowish-brown color and susceptibility to a fine satin-like polish the wood is particularly adapted for making all sorts of ornamental wood, wood carving, engraving, and for cabinets, chests, and drawers proof against insects. The chief reputation for sandalwood in Europe rests upon its use for carving. It is also employed for making jewel and work boxes, cabinets, writing desks, walking sticks, picture frames, fan handles, pen holders, card cases, trays, and when powdered is used to scent clothes. Large quantities of the wood are shipped to China for making coffins for the rich.

The exploitation of a number of other closely related or even entirely unallied species in the South Sea Island, and in parts of Africa was undertaken, but it has now practically ceased. It is said that several species of *Osyris* in East Africa will gradually supply the demand, but the wood is not only inferior to true sandalwood, but the production in any considerable quantities is doubtful. The export of the substitute sandalwoods from Australia is generally decreasing, while the supply from the Hawaiian Islands is entirely exhausted. That the production has ceased at the established sources of supply is not to be wondered at. Sandalwood cutting has been carried on in the most recklessly extravagant manner possible. In Hawaii and Australia the substitute sandalwood trees have all been cut out, and in many parts of Australia the stumps of the trees felled fifteen to twenty years ago, are now being dug up and shipped to the large markets in China.

In India attempts have been made for a number of years to keep up the supply by artificially restocking the forest, but the rate of planting has thus far been totally inadequate. Laws have been enacted to prevent the wanton destruction of the trees. Other causes besides extravagant cutting contributed to the decrease of sandalwood in India. Frequent fires and unrestricted grazing destroyed enormous quantities of young trees, and after careful investigation it was determined that a government monopoly in Mysore in Southern India was the only means of saving the most costly of all the Indian woods. This caused the quotations at home and abroad to rise. A good deal of the wood now brought to the market is cut in hedgerows and scrub jungles outside the areas marked as reserved forests. Since the monopoly is in force the sandalwood trade is more or less uniform from year to year, and the systematic exploitation of mature trees in the forest reserves will tend to keep the regular supply of the wood in the world's market.

Ammonia as a Disinfectant

RECENT experiments by Dr. Riegler of the Institute of Hygiene of Buda-Pesth have the highly important result of proving that ordinary ammonia is a powerful disinfectant, even in the case of the most virulent diseases. As reported in the *Centralblatt für Bakteriologie*, the method of use was most simple, consisting merely in placing the ammonia in shallow vessels in the room, which was then, of course, hermetically sealed.

For a room containing 100 cubic millimeters of space 1 kilogramme of ordinary ammonia was used, with these results:

After	1	hour	there	had	evaporated	200	gr.	of	liquid
"	2	"	"	"	"	250	"	"	"
"	3	"	"	"	"	300	"	"	"
"	4	"	"	"	"	350	"	"	"
"	5	"	"	"	"	390	"	"	"
"	8	"	"	"	"	450	"	"	"

Examination of tissues previously impregnated with microbes showed that the bacilli of cholera and typhoid were killed at the end of 2 hours; the bacteria and spores of anthrax in less than 3 hours; and diphtheria in 8 hours. The method is not only effectual, but cheap, simple, and non-harmful to walls, pictures, carpets, and furnishings.

The Current Supplement

THE front page illustration of our current SUPPLEMENT shows a roller gaging machine specially designed for the rapid and accurate measurement and assorting of bearing rollers.—F. V. Colville writes on "The Formation of Leaf Mold," a most important process in humus formation.—Prof. E. G. Coker, in an illustrated article, describes the application of optical methods to the determination of stresses in mechanical structures.—The history of the development of moving picture photography presents several points of interest, which, together with other points, are brought out in an article on "Kinematography Carried to Extremes."—A note, "How to Tell Artificial Silks," should be of interest to many readers.—F. W. Henkel writes on "Double and Binary Stars."—An article of particular value entitled "Sea and Air Command" discusses the Anglo-German war policy; England is re-enforcing its fleet; and Germany retaliates by building up a powerful air fleet.—A. H. Kennedy draws attention to the peculiar tendency of numerous natural processes to display a twist in a direction "Against the Sun."—A. O. Bourn writes on a new law of vulcanization.—P. H. Ling discusses the probability of the existence of an ultra-Neptunian planet, and the methods at our disposal for investigating the problem.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Winchester Cathedral

To the Editor of the SCIENTIFIC AMERICAN:

As a regular subscriber to the SCIENTIFIC AMERICAN and as one who has visited Winchester cathedral and taken much interest in its architectural history, I hope I may be permitted to offer a correction of the article in your issue of May 10th.

Under the title, "Saving a Cathedral With a Diver," you state that Winchester cathedral was built by William of Wykeham in 1079. According to the Encyclopædia Britannica, the cathedral was built by Bishop Walkelin (1070–1098) and remodeled by Wykeham in 1394. This agrees with the accounts in several books on English architecture in which is described the transformation under Wykeham in 1394 of the nave from the Norman to the perpendicular style.

New York. LEONARD OPDYCKE.

The History of the Arch

To the Editor of the SCIENTIFIC AMERICAN:

A correspondent in your issue of May 24th calls attention to the history of the arch, and expresses surprise that the true arch was not employed in the pre-Hellenic Ægean. The following facts, current among archæologists, may have bearing upon this question:

In Babylonia, clay was the common building material from the earliest times, as stone was not easily obtainable. Clay also *preceded* stone in Egypt (cf. Petrie's excavation in Abydos, 1902). In the Ægean, on the other hand, stone and wood were used; brick constructions are almost unknown (Troy II and III, where stone was hard to procure, and Asiatic influences predominated, do not furnish valid exceptions).

Beyond question the corbeled arch was the earliest type known, and a form familiar to the most widely separated peoples. Such highly finished cupola-forms as the famous "Treasury of Atreus" reach the acme of development in this direction. Here, naturally, Ægean architects stopped. Their stone arches were strong and handsome; what necessity was there for change?

In Babylonia (and Egypt) however, where unburned brick was used, such a structure could not have been lasting, since without adequate support the two opposite walls would soon fall in. While repairing this damage, what could be more natural for the mason than to stumble upon the idea of laying the bricks in directions converging toward the center? In this way the walls would be held apart, and a little buttressing would prevent the bulging. Indeed, the very ruins of our arch might reasonably suggest the improvement. With the burned-brick arch its evolution was complete, so far as Babylonia is concerned.

A few remarks regarding chronology may be *à propos* here. The correspondent quotes the chronology of Petrie and Breasted in the same breath, and they differ in the period under question by a thousand years! This leads him to an unfortunate inaccuracy in stating the relative ages of certain Egyptian arches. The dates given by Breasted are based on Eduard Meyer's researches, and are, in their broad outlines, accepted by nearly all Egyptologists. The Babylonian dates are no less than 1,500 years too high, as conclusively proved by Father Scheil's discoveries (1911–1912). Accordingly, 3000 B. C. should be read instead of 4500 B. C.

Menno, So. Dak. W. F. ALBRIGHT.

Suggestions on Reservoir Control of the Missouri

To the Editor of the SCIENTIFIC AMERICAN:

The writer studied with much interest your very forceful and unique illustration of the intricate and wonderful problem of the Missouri-Mississippi overflow conditions. The article of your chief editor is full of thought and facts.

It occurs to the writer that one must live in this great basin to realize the full significance of the problem before us. It is certain that the dike or levee system is inadequate, and it is doubtful if any system will ever be devised that will entirely cure the distress, for nature is limitless; though it is the opinion of the writer that a system of head-water control, added to that of levees, can and will cure any overflow equal to that of the past.

The cost of head-water control has many features of which we can take advantage. The western watershed of the twain rivers is much different from the eastern watershed; it is not nearly so abrupt, and flows across a broad plain from three to five hundred miles wide. In this plain are many natural basins, varying from a square mile to possibly fifty square miles. The comparatively level country will admit of dams costing from one hundred to the thousands, which will be sufficient to turn the channels of streams now running into the Missouri, not only stopping what the dams will hold, but a continuous stream.

Again the writer differs with the editor, in that the amount of discharge necessary to control the greatest floods is given as 2,300,000 cubic feet per second, which at once gives a problem beyond even the thought of the finite mind; but when you take into consideration that the normal discharge is 610,000 cubic feet per second, and that the natural banks will permit, without levees or overflow, three times this amount, or 1,830,000 cubic feet per second, then man has only to master 470,000 cubic feet per second, and to do that he has both the levee and reservoir helps before him. It has already been demonstrated that the levees will care for practically two thirds of this flow. In my mind it is quite feasible to care for the other third by head-water control.

With comparatively small cost, 300,000 square miles of the western watershed of these great rivers could be entirely cut off. This could be accomplished by the forming of a chain of artificial lakes stretching through North and South Dakota, Nebraska, Kansas, and Oklahoma. These lakes, formed by damming the tributaries crossing this country, could be connected by an artificial river, and the water in flood times turned into the natural basins or down this artificial river, and most of which would be used to irrigate these great plains.

Ness City, Kan. J. C. HOPPER.

The Mississippi Problem

To the Editor of the SCIENTIFIC AMERICAN:

For years I have been watching the floods which yearly devastate large sections of the Mississippi valley. I have also taken an interest in the plans put forth to lessen this evil, and have been greatly pleased with the stand your publication has taken in regard to this question of controlling the floods.

The question is of such vast importance, and affects such a vast area, that only by the most careful and painstaking study can a rational solution of the matter ever be reached.

Many writers seem to think that it is a subject that can be handled easily if the national Government will only accept their theory and begin work.

These floods are not of recent origin, but date back long before the advent of the white man in America. True, under the old conditions the waters did not reach the rivers as fast as at present, and the damage was confined to smaller areas than now.

All over the Mississippi valley were formerly scattered small sloughs, swamps, and lakes which served to hold back the flood waters, but the white man has changed all this. The bottom of these low places contained the richest soil in the country, and man is to-day looking for rich soil, and when a ditch, long or short, big or little, will uncover thousands of acres of land, he is going to dig that ditch, and the result is that in Iowa alone over four hundred millions are being spent in tiling and ditching, and the water which was formerly weeks in reaching the river now gets there in a few days, and what is more, untold thousands of gallons which formerly was held back until it evaporated, is now rushed to the big rivers at once. To-day there are not ponds and lakes enough in Iowa to hold back the water which falls in an hour.

This talk of building reservoirs, it seems to me, is the most ill-timed and weak of any proposition that could be advanced. To build reservoirs you must have deep valleys and high hills. In a large part of this country we have no place where a reservoir could be constructed. All the lakes and depressions in Iowa and Minnesota together would not hold the water of the Mississippi for one day when at flood. What is more, it takes more land to hold water impounded than when running off, and it would take five times the land to hold back the water that is flooded when the water is running away as fast as possible.

Those who advocate diverting the waters by digging canals have not seriously considered the size of the canal which would be necessary to give any appreciable help to such a river as ours when at flood.

If all the machinery of the Panama Canal was to be brought here and set at work, it could not in one hundred years cut a channel large enough to relieve the conditions which have come up during the past two years. Much can, no doubt, be done to clear our rivers from obstruction, but it is so much easier and cheaper to build an embankment three feet high than it is to excavate three feet from the river bed, that the two propositions need only to be compared to convince the most stubborn.

It is possible we have started to build our levees too close to the river, not allowing room for the water to spread out over enough ground. If so, we must back up and begin over. If we build levees the material is always at hand, and all the dirt put into the levees can be taken from the river side and thus help to enlarge the stream.

The history of drainage is the history of pouring the water from the upper land onto the lower. It has been going on since the country was first settled, and it will never be reversed. The upper land should and must help pay the expense of protecting the lower land, but they will never be able to send it up hill or hold the water back on the higher land.

Such floods as recently devastated Ohio and adjoining states cannot be entirely prevented. They will come like great fires and tornadoes, but much can be done to lessen the loss and relieve the suffering.

Where possible the Government should construct reservoirs, not so much to prevent floods as to hold back the water for power. Where practical, rivers should be straightened, but for protection we must depend upon dikes, and we must therefore make them high enough and strong enough to do their work.

Manson, Iowa. T. D. LONG.

The Moffat Tunnel

To the Editor of the SCIENTIFIC AMERICAN:

On page 509 of the SCIENTIFIC AMERICAN, published on June 7th last, there appears an interesting story, entitled "The Moffat Tunnel Through the Continental Divide." I quote part of it, as follows:

"It will reduce the route from Denver to Salt Lake City to 68 miles, as against 187 miles by the Denver & Rio Grande route, which is at present the shortest."

Our Book Club is a regular subscriber to your magazine and I read it with great interest; but in order that those who do not know that Western country may not gain a wrong impression from the above statement, I would respectfully suggest that it be revised and notice made of it in some future issue.

Having lived in Colorado for about four years, I presume that what the writer meant to say was that by driving this tunnel through the Continental Divide, the new route from Denver to Salt Lake would be materially shortened by going under the mountains rather than by climbing over them. The actual distance from Denver to Salt Lake by the Denver & Rio Grande is 741.1 miles, so that from this you can readily see the inaccuracy of the above statement. I make this suggestion in all friendliness and wish you continued success.

Boston, Mass. CHARLES A. BARRY.

[The note should have read: "It will reduce the present shortest route from Denver to Salt Lake City by 68 miles, and the Denver & Rio Grande route by 187 miles."—EDITOR.]

Pennsylvania Forestry Exhibition

To the Editor of the SCIENTIFIC AMERICAN:

During the week of May 19th to 24th, a most interesting exhibition was held under the auspices of the Pennsylvania Forestry Association at the Horticultural Hall in Philadelphia. The exhibition was free to the public, except on Monday, when a reception was held by the Association. In the afternoons and evenings illustrated lectures were delivered by men prominent in matters of forestry throughout the country. Among the exhibitors were included the Pennsylvania Department of Forestry, the Pennsylvania Chestnut Tree Blight Commission, Pennsylvania State College, Pennsylvania State Museum, Harrisburg, Pa., American Forestry Association, Washington, D. C., the United States Forest Service, Washington, the United States Reclamation Service, Washington, besides many other institutions, societies, and business corporations.

The exhibition was primarily planned to arouse public interest in the conservation and re-establishment of the forest wealth of the State. Through the lectures it was of remarkable educational value, and judging from the attendance, was far reaching in its effect. The fact that certain important bills for the protection of forests in Pennsylvania were at the time pending before the State Legislature, added to the value of the exhibition.

The lectures covered a wide range of subjects related to forestry and the conservation of our lumber supply. Among them may be mentioned "The National Forests," by Prof. Henry S. Graves, U. S. Forester; "Forestry and the Lumber Industry," by S. B. Elliott, Pennsylvania Forestry Reservation Commission; "Diseases of Our Forest Trees with Special Reference to the Chestnut Blight," by Irwin C. Williams, Deputy Commissioner of Forestry; and "What Forestry Can Accomplish," by Prof. J. A. Ferguson, Dean of the Department of Forestry, Pennsylvania State College.

If similar exhibitions could be held in all our lumber-bearing States, they would undoubtedly lead to the stimulation of public interest in the great economic question of saving what is left of our forests, and to the encouragement of legislation tending to help the replanting of devastated areas. E. J. D. COXE.

Philadelphia, Pa.

A Kocher Anniversary.—The University of Berne recently celebrated the 40th anniversary of Prof. Th. Kocher's teaching at that institution, this eminent surgeon having received the Nobel prize in 1909. On the present occasion Prof. Kocher made a donation of $40,000 to the university, which with the interests, is to form the basis of a fund of $100,000, this to be used for founding a biological institute in connection with the university.

Scott (on left) and companions in their fur sleeping bags.

Taking sample of sea water and temperature readings.

Cooking in the tent is surmounted under numerous difficulties.

Throwing the gang plank from the "Terra Nova" on "land," in this case thick ice.

To the South Pole With the Cinematograph

Film Records of Scott's Ill-fated Expedition

[*LITTLE need be said in introducing to our readers the photographs reproduced with this article on Mr. Ponting's remarkable work as a member of the ill-fated Antarctic Expedition in which Capt. Scott and four of his fellow explorers lost their lives. The excellent views here shown, which, aside from their artistic and popular interest, are of no inconsiderable scientific value, are part of the Gaumont moving picture film record now being exhibited in several of our large cities.*—EDITOR.]

In all the centuries of polar exploration north and south the records have fallen markedly short of perfection in one essential element, owing to difficulties that until recently seemed never to be overcome. It is in the matter of illustration that the failure has been most apparent. Scientific observations have been complete, graphic accounts of adventure and valuable reports of conditions have appeared in the writings of explorers from the very first. But artists with pencil and brush have failed to carry conviction and realization to the mind of the people who stayed at home, and photography even has fallen far short of perfection. The flat pictures of snow expanses and posed portraits of fur-clad explorers with dog sledges brought home by some of the most distinguished of explorers have been hardly more than commonplace, even though taken under the most trying of conditions. In real value, pictorial or scientific, they have served but little better than the quaint engravings of conventional icebergs and auroras of a hundred years ago.

It is in breaking this unvarying record that the British Antarctic expedition, under the command of Capt. Scott, achieved not the least of its noteworthy successes. That expedition from the beginning kept scientific objects ever in mind, and Capt. Scott organized a staff of specialists in every branch of natural science that could properly be expected to find material in the Antarctic. Furthermore, it was recognized that photography might well play a more important part than ever before, and for this reason there was attached to Capt. Scott's staff one of the most distinguished photographers and cinematograph operators in the world, Herbert G. Ponting, Fellow of the Royal Geographical Society, himself an explorer in many lands. Mr. Ponting approached his unique commission with a serious mind. He assembled equipment of photographic apparatus of a variety and perfection to meet every trying condition that could fairly be expected to develop in the Antarctic. He anticipated and organized for the difficulties to be met, and sailed southward toward the unknown with what was practically a new commission from science.

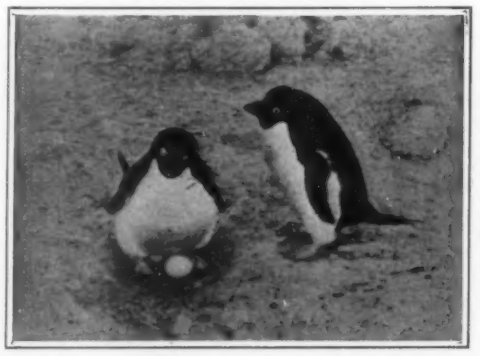
The result has proved the wisdom of the original plan and the excellence of Mr. Ponting's preparations. Literally thousands of negatives were made from the fall of 1910, when the expedition sailed south from New Zealand, until the time when it ultimately emerged with

A seal preparing to slip from an ice block into the sea.

Unloading the "Terra Nova." Carrying provisions to winter quarters on sledges.

A Weddell seal mother and her young. The skin of this seal has no commercial value.

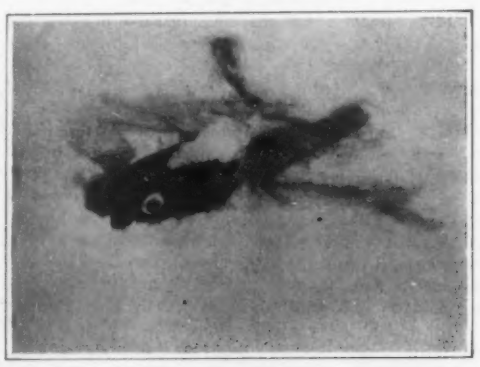
The tent in which the explorers died. It stood up well in terrible blizzards.



Penguin hatching egg on a nest of stones. Both male and female birds sit on the eggs.

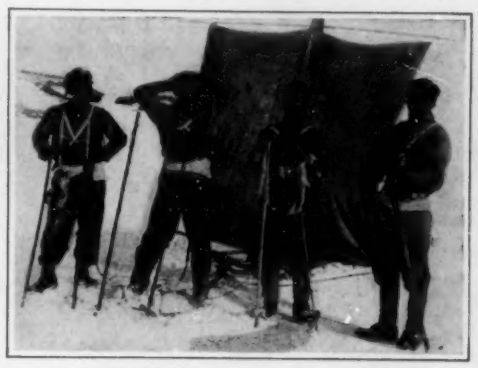
Preparing to unpack the tent after a hard and a long pull.

One of the Siberian ponies in active antarctic transport service.



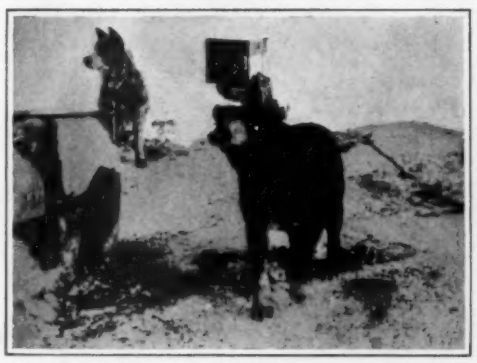
Hatching under a variety of difficulties; up to her neck in snow.

What the net brought up from the sea: sponges, starfishes, etc.



A square-shaped sail spread to assist in drawing a snow-sledge.

Dr. Wilson with one of the fourteen Siberian ponies.



Two of the team of Siberian dogs that were always reliable.

the news of the disaster to the polar party last February. Besides the individual photographic negatives Mr. Ponting brought back with him over 25,000 feet of films, and important selections from these are now being shown by cinematograph in several American and European cities.

In spite of the difficulties that beset Mr. Ponting in this undertaking, the results, photographically speaking, are worthy of being ranked with the best that have ever been shown with the cinematograph.

The difficulties began almost from the moment of starting. In order to photograph the actual progress of the bow of the "Terra Nova" in forcing its way through the ice pack in the Antarctic Ocean, a staging built from two planks lashed to the deck and the rail was extended far out over the side of the ship, and partly resting on this and partly suspended by rope from above Mr. Ponting sprawled on his face and turned the crank of the cinematograph, while some of his most successful exposures were made.

Preliminary to arranging for the display of these pictures, Mr. Ponting made a recent visit to the United States, and had many interesting things to tell of the conditions under which he had worked.

"Difficulties?" said he, in telling his adventures shortly after reaching this country, "of course there were many of them. Compared with polar photography, everything is easy. It is not only the difficulty of the light. That is soon mastered. The temperature is where the real trouble comes from. If you take off your glove and put your naked hand near the lens, instantly the lens is covered with a film of ice that no mere rubbing will remove.

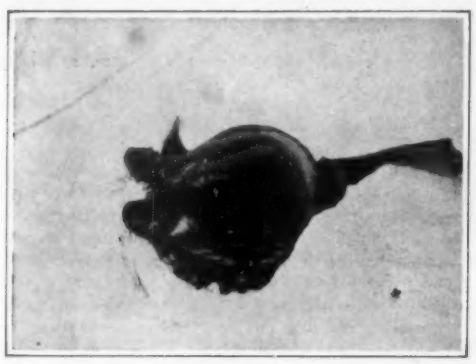
"Sometimes moisture, condensing into the finest particles of ice, will get inside the lens—then you are through. A grave danger anent the camera is the brass knobs. If by accident, you touch with your bare hand any part of the brass of the apparatus, it will burn you just like a red-hot iron. On one occasion I was focusing under my cloth when I happened to moisten my lips. The point of my tongue came in contact with the metal and instantly froze there; the shock was so great that I went over backward, and when I recovered, I found that I had lost the tip of my tongue, which remained frozen to the camera.

"I recall one instance when I thought every moment was my last on this earth (or rather on Antarctic sea-ice). None of us were familiar with the ferocious killer-whales, and so when we sighted a large school of them after seals, I disembarked and hastened over the ice to film the thrilling scene. Imagine my amazement when they gave up their chase after the seals and attacked me. Over a dozen of them formed into line, and diving under the ice, heaved their backs against the ice, breaking it up for hundreds of yards, and it was all that I could do, with the assistance of my comrades, to regain the safety of firm ice again with a school of vicious whales exerting their every effort to get me into the frigid waters.

(Concluded on page 568.)

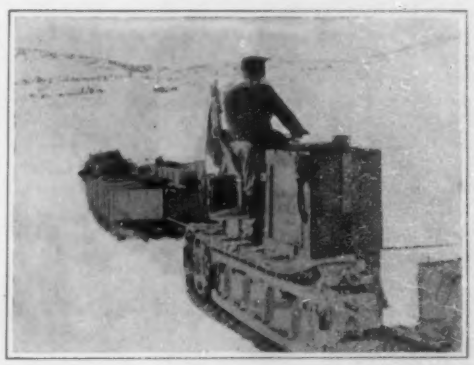
View of the end of a sledge with a cyclometer attached.

Mr. Ponting among the penguins, and at a very close range.



Seal in the act of scooping steps in the ice with his teeth.

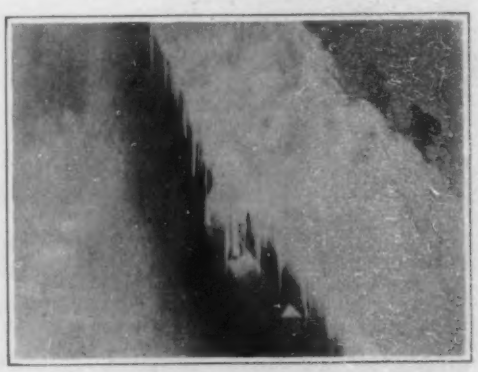
Skua-gull with its chick, which it will furiously defend.



One of the motor sledges hauling a number of trailers with supplies.

Penguins building their nests, which are formed into mounds of stones.

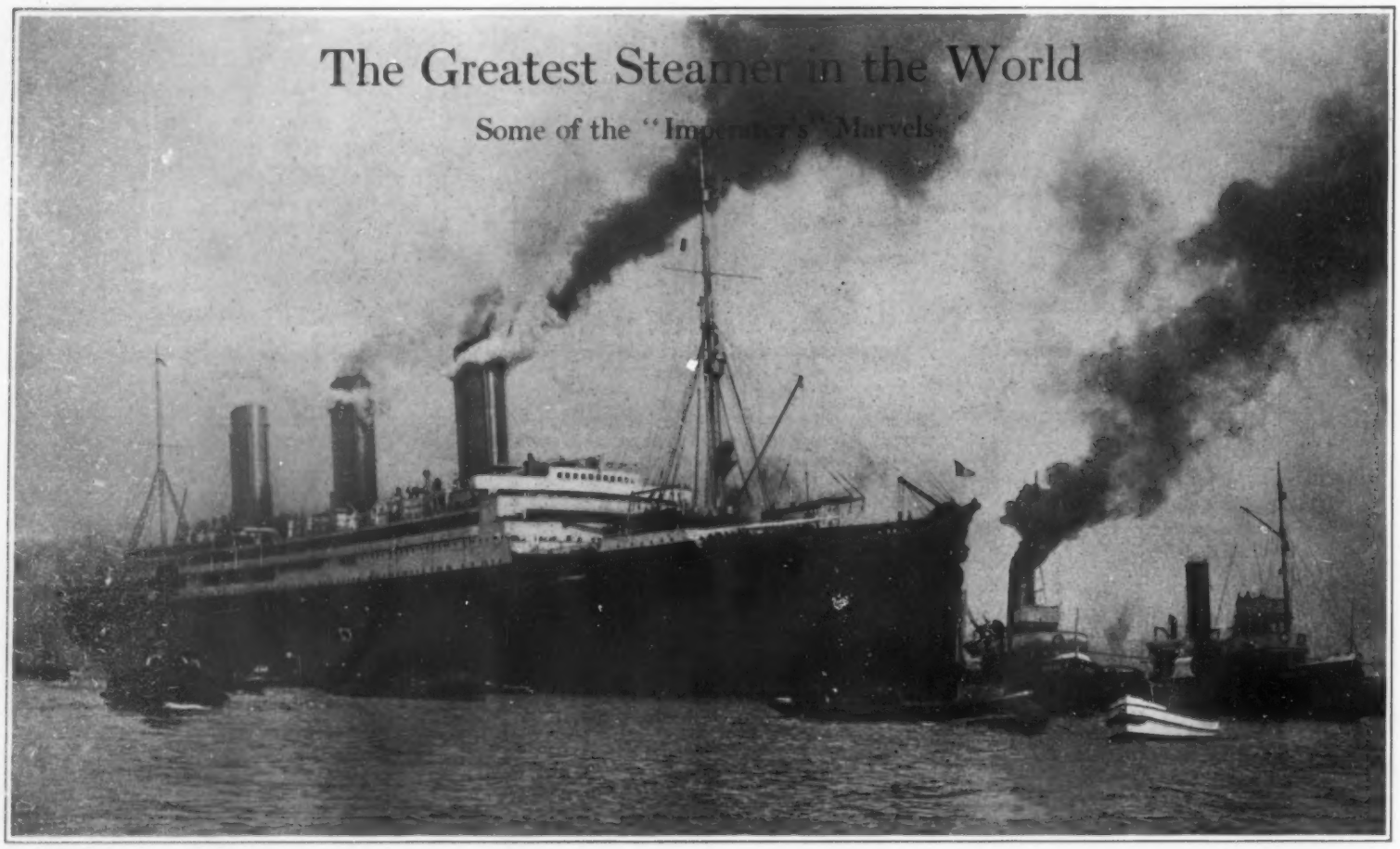
A flock of penguins. These birds are unable to fly with their clumsy wings.



Climbing an overhanging glacier of peculiar form. A perilous feat.

The Greatest Steamer in the World

Some of the "Imperator's" Marvels



THE "Imperator," which is the newest of the liners built to ply the waters between the United States and Europe, is also the greatest. She is almost one fifth of a mile long—to be exact, 919 feet. Her beam is 98 feet, which compares favorably with that of a pretentious city street; and her tonnage is 50,000.

No less remarkable is her machinery. The "Imperator" is driven by quadruple turbine engines developing 62,000 horse-power, which drive the ship at an average speed of 22½ knots. The reversing turbines develop about 35,000 horse-power. There are four propellers measuring more than 16.4 feet in diameter and revolving at a normal speed of 185 revolutions a minute.

Since mere figures tell but little, perhaps the real size of the "Imperator" may be best judged by her accessories. For example, no less than five great anchors are carried, of which the main anchor, the largest in the world, weighs 26,455 pounds. The combined weight of the five anchors and their chains is 485,082 pounds. The cargo of many a small steamer is not much larger.

Some idea of the size of the "Imperator" may also be gained from the fact that her sides are built upon 327 steel ribs, on either side, each weighing a ton and a third. The weight of the steel plates, angles, profiles, and the like, totals 200 tons. More than 2,000,000 steel rivets were used, eaching weighing eleven pounds. No wonder that the tonnage of the "Imperator" is fifty thousand.

Because of her great size her decks are particularly imposing. Two of her three broad decks are partially inclosed. The promenades vary in width from 16 to 23 feet, while the circuit of the deck is equal to a walk of about five ordinary city streets. None of the ventilating funnels common to many steamers are to be found on the "Imperator." Hence her entire upper or sun deck can be used for games and for promenading.

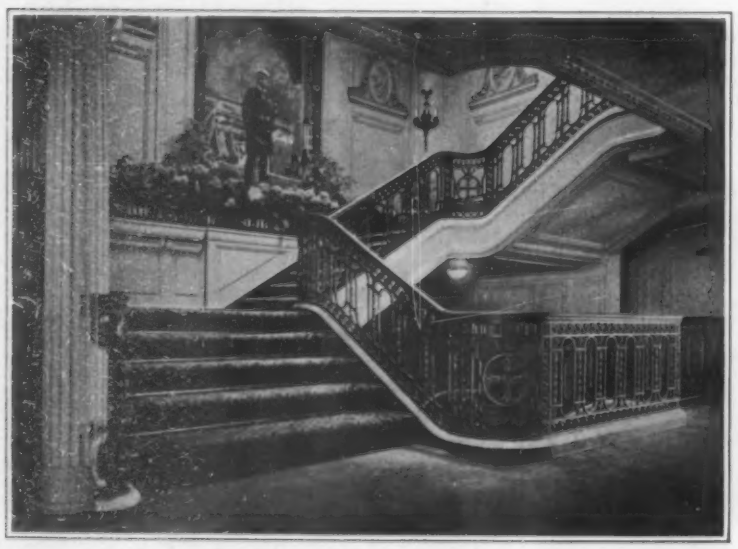
That the "Imperator" is in truth huge is driven home by the quantity of provisions carried. For a seven-day voyage between New York and Hamburg the "Imperator" takes on board 25 tons of fresh meat, 48,000 eggs and 60 tons of potatoes. The larder besides contains 14 tons of fresh vegetables and 6,000 tins of canned vegetables. Besides, there are over five tons of fowl and game, and 4½ tons of fish and shellfish, 800 pounds of mushrooms and 4,000 cans of preserved fruits. No less than 12,500 quarts of milk and cream, 400 pounds of cheese, 500 pounds of chocolate and cocoa, and 7,000 pounds of coffee are also taken on board.

A more comfortable or more luxuriously equipped craft than the "Imperator" it would be difficult to imagine. The passengers have a great choice of dining-rooms, ballrooms, winter gardens, palm rooms, grill rooms, smoking-rooms, gymnasiums, roof-gardens, and lounges. There is a practical stage for theatrical performances, a running track, an elaborate Roman bath and swimming-pool, a florist's shop, a candy shop, a photographic dark room, electric elevators, and other features not found on most transatlantic steamers.

The furnishings of the "Imperator," too, are remarkable. The leading decorators of Europe have been given *carte blanche*. Thus, the main lounge, which may be converted into a ballroom, is hung with Gobelin tapestries. The sumptuous Roman bath reproduces with great fidelity the famous Pompeian Hall in the Louvre. The pool, which is surrounded by decorative Pompeian pillars, measures twenty-one by thirty-nine feet.

The provisions for safeguarding passengers on this largest of ships will naturally arouse interest. As we have already pointed out in these columns, the "Imperator" is built with an inner skin, and with both longitudinal and transverse bulkheads. All told there are no less than sixteen steel bulkheads, forming in all thirty-six watertight compartments. Further subdivision is secured by steel decks. The bulkheads have been carried to the level of the second deck, high above the water line. That they will perform the function for which they are designed has been proven by actual test; for the compartments have been completely flooded to ascertain their efficiency under extreme conditions. The compartments are hydraulically closed from the commander's bridge. Auxiliary controls are to be found on the upper deck.

Eighty-three large lifeboats are provided—sufficient to accommodate 2,496 passengers and a crew of 1,180. Two of these are motorboats, high-powered enough to tow the others, and equipped with wireless telegraphy



The main staircase of the "Imperator."

The smoking-room has a large tastefully designed fireplace.

apparatus having a range of over two hundred miles. Besides the usual life-belts, illuminated life-buoys are provided.

The wireless equipment of the "Imperator" has a range of 1,500 nautical miles. There are two reserve antennæ and two receiving instruments for long and short waves, designed for news service and rescue work. The station is manned by three expert operators, one of whom is constantly on duty. So powerful is the wireless equipment that the vessel will always be within etheral hailing distance of land.

An International Commission on Agricultural Meteorology

THE International Meteorological Committee recently appointed a commission on agricultural meteorology, comprising the following members: M. A. Angot, director of the meteorological service of France; Dr. Richard Börnstein, professor at the agricultural high school at Wilmersdorf, near Berlin, and organizer of the public weather service of Prussia; Prof. P. Brounov, director of the meteorological bureau attached to the Russian Ministry of Agriculture; M. Louis Dop, vice-president of the International Institute of Agriculture; and Prof. L. Palazzo, director of the meteorological service of Italy.

From an agricultural point of view the most interesting person in this group is Prof. Brounov, as the bureau which he has directed since its organization in 1897 is the most elaborate agricultural-meteorological institution in the world. It comprises about one hundred and fifty special stations scattered over the Russian Empire, at which meteorological observations are made side by side with observations on the growth of plants. To each station is attached a tract of land planted in cereal crops, orchards, etc. An effort is made to keep the agricultural conditions of these plots unchanged from year to year, in order that the exact effect of the varying weather conditions may be ascertained. The most important practical object in view is to gage accurately the agricultural climate of every part of the empire in order to guide cultivators in the choice of crops and varieties, and in timing their operations. The bureau has issued a large number of publications of general interest, but nearly all, unfortunately, in the Russian language.

M. Dop is prominently identified with the agitation now in progress in Europe in behalf of improving the organization of meteorological work as applied to agriculture. He recently prepared an elaborate report on the present status of such work throughout the world, which was published by the International Institute of Agriculture.

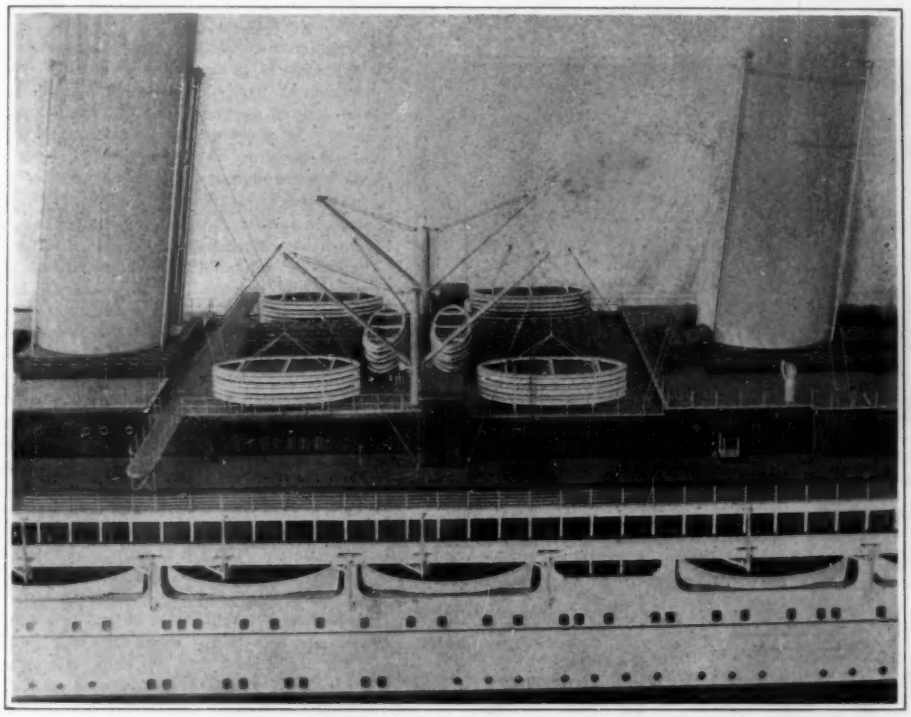
The new commission held sessions last September and drew up recommendations. Some of the things recommended are: Improved methods of measuring the duration of sunshine and the intensity of radiation from sun and sky; more detailed study of fog, dew, and hoarfrost; better methods of measuring the temperature of the air at various levels among and above growing plants; the study of optical phenomena useful in making local weather predictions; changes in the methods of publishing meteorological observations in order to serve the practical needs of agriculture; publication of daily weather maps at several distributing centers throughout each country (i. e., the plan now followed in the United States and latterly in Germany, but not elsewhere); an evening weather service, where this does not already exist; and the rapid dissemination of weather forecasts and warnings in the rural districts (after the example set by the United States Weather Bureau).

There is a feeling among agriculturists throughout the world that they are not getting the full benefit of the elaborate organizations for weather observation and prediction that now exist in all civilized countries. In this respect, however, the American farmer is much better provided for than is his brother of the Old World. We already have an adequate meteorological service; and the development of agricultural meteorology rests rather with the agriculturist than with the meteorologist.

Preservation of Wood

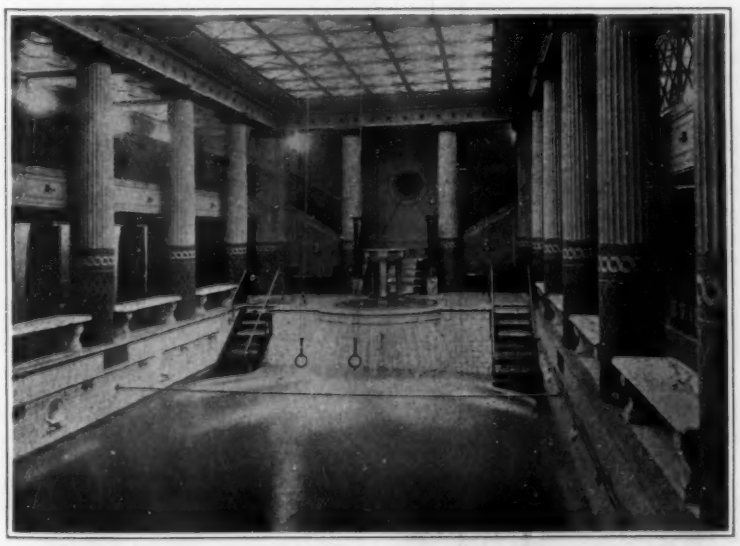
EPINOY utilizes the property of the alkaline bichromates to render gums and gelatines insoluble when exposed to the light. For this purpose the wood is immersed until complete saturation in a solution containing 2 per cent bichromate of potash and 1 per cent fluoruse of sodium. After drying, the wood is proof against rotting. The wood is then painted with a solution containing 2 per cent bichromate of potash, 0.4 per cent fluoruse of sodium and 5 per cent of gelatine, and is exposed to the light; after drying the wood will be covered with a very strong, brilliant varnish, and assume a brown color, like aged wood.

Government Armor Plant.—A bill has recently been introduced in Congress by Senator Ashurst of Arizona, appropriating $1,600,000 for the construction of a Government plant for the manufacture of armor plates. The author of the bill believes that if Government-built armor were used in the battleship "Pennsylvania," it would save $1,600,000. Secretary Daniels estimates that an armor plant would cost approximately $3,000,000, but Mr. Ashurst has called for a lower appropriation based on estimates made by a Senate committee in 1896.



The "Imperator" carries eighty-three large lifeboats, two of which are motor-boats equipped with wireless having a range of two hundred miles. Note the manner in which the lifeboats are carried.

Staircase leading to the Pompeian pool, a sumptuous Roman bath reproduced from the Pompeian Hall in the Louvre.



The swimming pool is sixty-five feet long and forty-one feet in width.

Concert stage in the grand salon of the "Imperator."

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

The Loud-speaking Telephone

IN the development of loud speaking equipment for announcing purposes, two problems are presented—one that of obtaining sufficient volume, and the other that of obtaining clear articulation. From time to time during the past few years, a number of so-called loud-speaking telephones have been developed and placed upon the market. These have either been loud and lacking in clear articulation, or clear in their articulation and lacking in volume, thus failing to strike the desirable medium of clear articulation and sufficient volume.

The question of volume itself necessitates two lines of study, one to obtain that design of apparatus which will permit the largest current being used without injuring the apparatus, and the other that of obtaining the greatest efficiency from the available energy.

In the transmitter, the amount of current which can be used is limited by the mechanical dimensions of the instrument and the means which may be available for keeping the instrument properly cooled. If, however, the mechanical dimensions are too great, particularly those of the moving parts, the articulation is seriously affected. Accordingly, the amount of current which can be used is also limited.

The quality and articulation are largely dependent upon the mechanical dimensions of the diaphragm and the manner in which it is mounted. In any diaphragm a certain tone will be found which is fundamental to it; and as the weight of the moving part which is attached to the diaphragm is increased, this tone becomes emphasized. If the moving mass is not kept exceedingly small, this tone interferes with the proper reproduction of the words transmitted.

The problem of designing an efficient transmitter for this service has, therefore, been that of making use of the largest possible mechanical proportions in order to permit of large currents, without making the moving parts too great in mass to destroy distinctiveness of articulation.

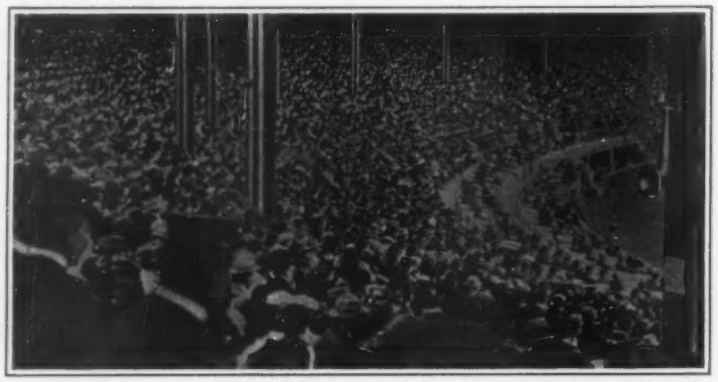
The one particular point followed in the design of the loud-speaking apparatus has been the obtaining of a method of construction which will give greater emphasis to the harmonics of the voice and less to the fundamental note. In general, this method will give far better results as far as intelligibility is concerned. This principle has been followed out consistently in the construction of both the transmitter and receiver used in the loud-speaking combination.

As in the case of the transmitter, the articulation of the receiver is governed largely by the mechanical characteristics of the diaphragm and the method in which it is mounted. In the receiver, the diaphragm has been corrugated and mounted on rubber cushions along the lines of phonograph construction. It was, however, found advisable to depart from one of the usual features of receiver construction and use a metal other than iron in the construction of the diaphragm. This was made possible by the use of an iron armature which would be acted upon by the pole pieces. Phosphor bronze was found to produce the best result from the standpoint of both volume and articulation and has, therefore, been used for the diaphragm. A lever arm connects the diaphragm to the armature.

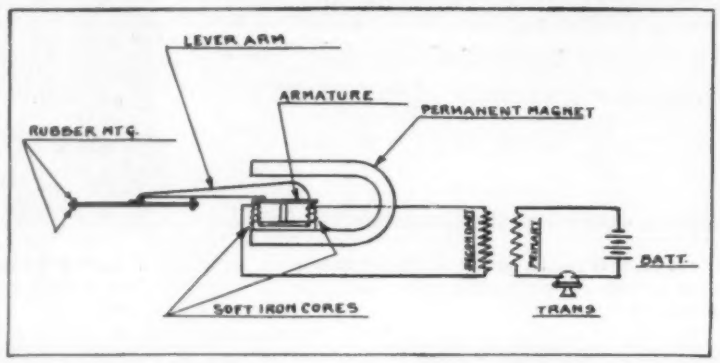
By employing the magnetic principles used in the construction of polarized ringers, the efficiency of articulation was found to be still further increased. This fact may be accounted for by the resultant reduction in the inertia of the moving parts. The use of a differential magnetic circuit in the receiver has also made it possible to obtain a two-way positive action of the diaphragm. In the normal condition of the receiver the diaphragm is practically free from all tension. This has the effect of greatly increasing the efficiency of construction, due to the fact that a much smaller air-gap may be used.

These new and entirely original constructive features have produced a loud-speaking telephone which combines clear articulation with a maximum of sound volume.

The first public appearance of the loud-speaking telephones was at the Boston Electrical Show, held in Mechanics Hall, during September and October, 1912. Ninety of these telephones were installed in various parts of the hall and divided, for convenience, into groups of ten, making nine separate circuits, which were originated in a sound-proof glass-inclosed booth in the basement of the Grand Hall. In this booth the special transmitters were located, as well as an ordinary telephone set connected to the lines of the New England Telephone and Telegraph Company. The installation of the telephones was made to demonstrate their use as announcers—to announce interesting events about to take place, to page visitors to the show, and to furnish music from a phonograph in the transmitting booth. Another use to which they were put was to announce the inning-by-inning scores of the World's Series baseball games then taking place. That the telephone produced practical results was evidenced by the fact that a child which had been separated from its parents in the throng was found through its agency; and it was no unusual thing for exhibition officials to be summoned to their offices or to meetings by means of these instruments.



Announcing the score at a baseball game by means of loud-speaking telephones.



Diagrammatic view of the loud-speaking telephone, showing the lever connection to the receiver diaphragm.

Ready to charge with liquid air.

The work of the explosive.

Liquid air blasting tests at Rüdersdorf quarries.

Blasting With Liquid Air

By Our Berlin Correspondent

THE first attempts to use liquid air as an explosive were made at an early stage of the liquid air industry. In fact, shortly after the invention of his process, Prof. von Linde (in 1897), by mixing liquid air with charcoal, succeeded in producing an explosive which he termed "oxyliquite." This pulpy explosive was introduced directly into the blast hole and ignited by means of cartridges and fuses. As, however, this primitive process failed to give any satisfactory results, the explosive mass was filled into carefully prepared paper cylinders (preferably immersed entirely into liquid air), which were then introduced into the blast hole. Though sufficient explosive effects were thus obtained in most cases, this process did not warrant anything like real safety and depended in an extraordinary degree on the skill of the men and the rapidity of working.

These unsatisfactory results are due on one hand to the physical properties of liquid air itself and on the other to the imperfect process used in preparing the explosives. Liquid air at ordinary atmospheric pressure, i. e., in the open air, of course possesses a temperature of —191 deg. Cent. (—311.8 deg. Fahr.) and liquid oxygen a temperature of —182 deg. Cent. (—295.6 deg. Fahr.), the temperature difference as compared with the surrounding rock thus being about 200 deg. Cent. (360 deg. Fahr.) It will thus be readily understood that a lively exchange of temperature by heat conduction and radiation should be set up between the explosive and its surroundings, the liquid air in the blast hole being vaporized most rapidly by the absorbed heat. In fact, the explosive cartridges used in connection with these early experiments were found to possess a maximum life of 10 minutes at the outside, their efficiency being considerably reduced even after a shorter life.

After being discontinued for many years, these experiments were recently taken up again by a German mining engineer, Mr. Kowastch, who in conjunction with Mr. Baldus of Charlottenburg, was allowed to work at the Royal Quarries of Rüdersdorf, near Berlin. In accordance with the above, Mr. Kowastch tried to prevent the liquid air in the blast hole from evaporating by any possibility beyond a given limit. He therefore conceived the idea of introducing the cartridge with the dry carbon holder separately into the blast hole without the liquid air, and afterward making any mining preparations (tamping the blast hole, etc.), waiting until the very last moment to add the liquid air and igniting the mixture immediately afterward. This process obviously allows the time of vaporization to be reduced to a minimum, thus saving much of the liquid air otherwise required, cheapening the process and warranting an incomparably higher safety.

A substantial pasteboard cylinder containing a perforated distribution tube and filled with an absolutely inert mixture of kieselguhr and oil, asphalt, soot, or paraffin, is introduced into the blast hole. Into the central distribution tube is introduced a thin supply tube (of paper) over which another paper tube for discharging any products of vaporization of the liquid air is slipped, after which the tamping can be safely proceeded with. Whenever several blast holes are to be fired simultaneously, the electrical conductors are properly connected with one another and with the igniting battery.

(*Concluded on page 569.*)

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

BOOT LACE.—H. W. SHORT, 238 Seven Sisters road, London, England. The object here is to obviate the necessity of tying now in use, and to provide a neat finish for the lace. This is accomplished by use of a lace which in effect is endless and of approximately the exact length required only for engaging with all the hooks, the extremities of the lace being permanently connected together by means of a flexible and extensible spring coupling.

HAT PIN.—D. PERKINS, Jr., Plano, Cal. The invention provides a pin with two telescopic tubular members, with means for holding these members yieldingly extended, so that a pin of a breastpin may be inserted in the members, which may be pressed together to permit the breastpin to be secured to the members as an ornament therefor. A pin is secured to one of the members, and is of the length required to permit it to be used by women for securing the hat in place.

CAP.—J. TIM, 91 Mercer St., New York, N. Y. The object of the inventor is to provide a woman's cap of the knitted class, with the muffler as a part thereof, the construction and arrangement being such that the muffler may be secured in position around the neck or may be held secured on the cap when so desired.

Pertaining to Aviation.

AEROPLANE.—S. N. MALTERNER, Canton, N. Y. Mr. Malterner's invention relates to aeroplanes, and comprises improved means for adjusting the angles of the main planes or lifting planes together, in the same direction or in opposite directions, as required by the various conditions that arise in actual practice.

Of Interest to Farmers.

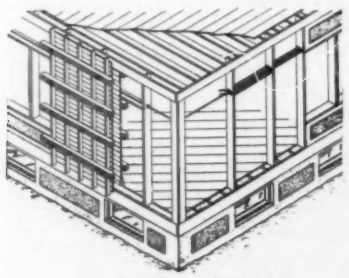
PLANTER FRAME.—A. M. CRISMAN, 242 Belle Ave., Davenport, Iowa. The invention provides a frame for seed boxes and furrow openers for planters of the type in Mr. Crisman's patent No. 995,225, to insure that the furrow openers will follow a more uniform depth, and wherein the frame will maintain itself in a level steady position, and at the same time the furrow openers may be moved into and out of the ground in an easier and more expeditious manner.

ATTACHMENT FOR MILK PAILS.—J. A. BLAIR, Steuben Township, Pa. This invention provides a device for holding a strainer in position across the open top of a milk pail. It provides an attachment for pails, of simple design, and make-up, which may be produced at a low cost.

Of General Interest.

MEANS FOR PRODUCING A CORRECT WRITING HABIT.—MARGARET M. HUGHES, 78 Clinton Place, New York, N. Y. The purpose here is to provide a means for producing a correct writing habit in a comparatively short time and to teach a pupil the correct formation of the written letters of the alphabet, numerals, signs and other indicating characters pertaining to penmanship.

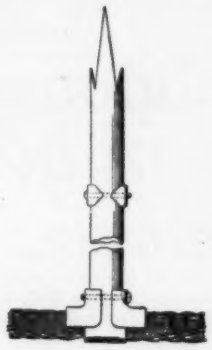
WALL CONSTRUCTION.—A. F. MEYER, 1001 Germania Life Bldg., St. Paul, Minn. Among the several important objects of this invention, is the provision of a wall construction designed to eliminate all planes of weakness and permeability resulting from the deposition of concrete in successive horizontal lay-



WALL CONSTRUCTION.

ers and to make possible and practicable the production of a pleasing and durable finish by means of brushing and washing the partially hardened concrete. Further, to provide a construction which embodies the assembling of a framework disclosing window openings and ordinary panels for the walls, the last being filled with concrete or other cast material, each panel being cast as an integral block.

LIGHTNING ROD.—J. Z. CURNUTT and E. E. LLOYD, Lock Box X, Maryville, Mo. As is well known, the efficiency of a lightning conductor depends largely upon the amount of the exposed surface which is free, or out of contact with any other; and the object of the invention is to provide a rod having a maximum free surface and minimum weight. The inventors produce a cable that has great tensile strength, and large conducting surface.



LIGHTNING ROD.

The engraving shows a side view of a portion of the cable or rod proper and a top or point secured thereto.

Hardware and Tools.

SHOVEL.—W. S. KELLY, care of Mary H. Kelly, 534 First Ave., So. Seattle, Wash. Mr. Kelly's invention has reference to a shovel particularly adapted for cleaning material from the floor of mills, and an object of his improvement is to provide a reinforced shovel having the maximum bracing effect for the least amount of material used.

CASTER.—J. W. HILFRANK, care of N. Y. Orthopaedic Hospital, White Plains, N. Y. The invention relates to casters, such as are used on hollow legs of metal bedsteads and like articles, and it provides a caster arranged to permit of conveniently applying the caster to the terminal of the hollow leg and to insure the proper working of the caster when moving the bedstead or other articles about.

CORK EXTRACTOR.—V. HAINISCH, via Bellognardo 16 Trieste, Vienna, Austria. In removing corks from bottles with a screw-like extractor, it often happens that no portion of the cork is removed when the extractor is drawn out, except that held between convolutions of the screw. The cork puller must then again be inserted, which is done with difficulty, and the cork afterward removed, often in sections. Sometimes the upper half

CORK EXTRACTOR.

is removed by the corkscrew while the under remains in the neck. This is due to defect in the cork, and because the upper portion of the neck is often constructed so that the lower portion of the cork offers greater resistance than the upper, in removal. The inventor, as shown in the engraving, overcomes these difficulties by constructing the lower portion of the screw of a greater diameter than the upper.

Household Utilities.

SANITARY CLOSET.—J. J. GRAHAM, 116½ Florida Ave., Jacksonville, Fla. The present invention has reference to improvements in water closets, and particularly to closets arranged in an outhouse, and has for an object to provide an improved structure in which a vent pipe is provided and means for causing proper circulation of air.

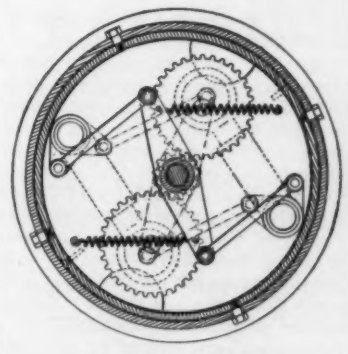
EXTENSION CURTAIN POLE.—J. KRODER, 107 E. 17th St., Manhattan, N. Y., N. Y. This invention provides a pole, more especially designed for use between the jambs of doors or windows, and arranged to permit of conveniently placing the telescoping pole sections in position on supporting brackets and locking said pole sections on said brackets to prevent accidental disengagement.

Machines and Mechanical Devices.

BOOK COVER CLEANING MACHINE.—C. J. RICH, Norwood, Mass. An object here is to provide means whereby the surplus gold or other filling substance may be rapidly and positively rubbed off the finished surface, and the device has for a further object, to provide means whereby gold or other material adhering to the rubbing tool may be brushed off the tool.

COTTON COMPRESS.—W. HILL, Alexandria, La. The inventor provides a compress with means for moving one of the compressing members upon the article to be compressed, at a relatively high rate of speed, and provides connections between the moving members of a compress to secure a relatively rapid rate of movement of one of the members and thereby diminish the time required to operate the compress.

TRANSMISSION DEVICE.—T. H. WILLIAMS, Buxton, Iowa. The improvement comprises a driving member and a driven member so connected that the driven member can be turned either in the same direction as the



TRANSMISSION DEVICE.

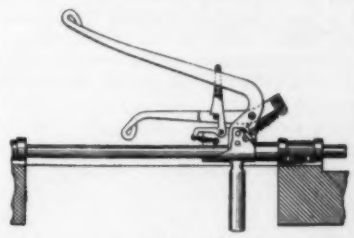
driving member or in the reverse direction, or caused to remain stationary without disconnecting any of the component parts of the transmission device which are used for imparting motion from one member to the other. The speed, when the driven member is turning in the same direction as the driving member, can be varied or adjusted to any extent.

Prime Movers and Their Accessories.

BEARING.—W. I. CHINNICK, Trenton, N. J. This invention provides a bearing which can be applied to all the various purposes for which bearings are used, which is strong, compact and light, and which can be rapidly adjusted by a simple manipulation, to take up wear and to fit the bearing exactly to the member journaled therein.

Railways and Their Accessories.

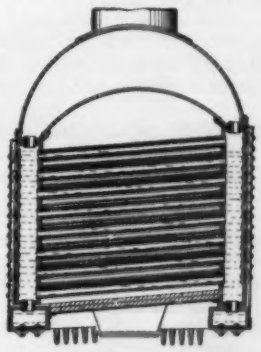
MAIL BAG CATCHER.—F. HANSEN, Woodbine, Iowa. This mail bag catcher of the hook or crane type is for use in connection with fast moving mail cars to take up mail bags from the station apparatus. One of the objects of the invention is the employment of a retaining device which is automatically tripped by the bag as it reaches the elbow of



MAIL BAG CATCHER.

the hook, and thereby grips the bag and retains it on the elbow, said device being easily set in operative position and so held by a latch which is struck by the bag to release the retaining device.

BOILER.—F. ELIZONDO, Contruas 28, Matanzas, Cuba. The object of this inventor is to provide a boiler more especially designed for use on locomotives and arranged to provide a large heating surface, to insure a rapid



LOCOMOTIVE BOILER.

circulation of the water, and quick generation of steam, to avoid exposure of rivets to the heat of the burning fuel in the fire box and thus reduce leakage to a minimum, to permit easy cleaning of the boiler, and to avoid incrustation.

CAR FENDER.—W. T. WATSON, 616 Davie St., Vancouver, B. C., Canada. This invention provides an attachment whereby the operating apron of a scoop fender is lifted from tripping contact with obstructions on the road bed other than accidental obstructions which it is intended should operate the fender; and provides means for avoiding the operation of the scoop fender by inequalities of the road bed, or employment of a gate construction dangerously raised to avoid said inequalities.

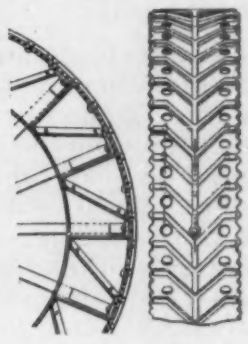
Pertaining to Vehicles.

HORN FOR MOTOR CARS, MOTOR CYCLES AND CYCLES.—E. TESTE, 18 Rue des Bois, Paris, France. The purpose here is to provide a hooter (such as is used on motor cars and other vehicles) capable of being caused to emit a number of different notes or sounds, and wherein the change from one note or sound to another is produced automatically by successive pressures on air bulb.

TIRE SUPPORT.—A. HARNISHFEGER, care of Frey, Welman & De Bruler, Evansville, Ind. This support is for use on the side or rear end of an automobile for safely carrying one or more extra tires held on a demountable rim and arranged to permit of conveniently placing the tire and its rim in position on the support and carrying it safely along, and to allow of removing the tire whenever needed for replacing a wornout or burst tire.

JUMP SEAT FOR GO-CARTS.—MARGARETTE M. DANIELS, 523 W. Ellsworth St., Denver, Colo. In this case the invention has reference to detachable front seats for go-carts, usually termed jump seats. The object of the invention is to provide a spring-supporting jump seat having novel means for securing it to the folding frame of the go-cart at the front.

TRACTION WHEEL.—D. B. HUSTED, Mantua, Ohio. This improvement refers to a traction wheel particularly adapted for use on agricultural vehicles, and an object is to provide a plane band traction wheel having a



TRACTION WHEEL.

high degree of traction, which wheel may be readily converted into a rough shod traction wheel. The wheel positively grips the solid earth beneath the mud or slush when in the form of either a rough shod or a plane band wheel.

TIRE FASTENER.—L. G. FLEMING, Tarrytown, N. Y. The inventor provides an improved tire fastener more especially designed for use on automobile wheels and the like, and arranged to permit of securely fastening the tire in place on the rim of the wheel or quickly removing it therefrom for repairs or other purposes.

AUTOMOBILE NUMBER CARRIER AND DROP.—G. H. HEWITT, Jr., care of Kern & Ward, 20 Broad St., New York, N. Y. This invention facilitates the identification of automobiles and other motor vehicles in case they are involved in an accident or collision, or during the confusion following a collision or accident when it often happens that the injured party or the bystanders neglect to note the license number of the car, or fail to remember it accurately.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Price Maintenance and Modern Merchandising—I

Price Fixing by a Monopoly and Price Fixing by a Single Manufacturer

By Waldemar Kaempffert

[THIS is the first of a series of short articles intended to set forth in a simple way the economic necessity of fixing and maintaining the retail price on certain kinds of manufactured products. Merchandising methods have changed within the last twenty years—changed chiefly because nation-wide and world-wide selling has been made possible by advertising. In this remarkable development of business, economic discoveries have been made which are not yet widely known. It is the purpose of these articles to set forth these discoveries so far as they affect price maintenance.—EDITOR.]

A single term is often used to designate two different acts or things, the one good and the other bad, with the result that it is sometimes difficult to distinguish them. "Politician" has acquired a very sinister meaning in the United States; yet in England a politician is a very respectable member of the community. So, the words "price maintenance," "fixed prices," and their equivalents have come to mean popularly "trust control," whereas business men employ them also to designate a form of control that is far removed from monopolistic domination and that is in reality a healthy stimulus to competition.

Between an agreement of twenty refiners to sell sugar only at 10 cents a pound and the policy of a single manufacturer to sell his trademarked or patented articles at a uniform retail price there is a world of difference. The people *must* buy sugar at the price fixed by the combination of refiners, assuming that they control the raw material; for there is no other source of supply. But the people need not buy the trademarked or patented breakfast food of the single manufacturer; for there are a hundred other breakfast foods to be had, if the price is too high. It is curious that the term "price maintenance" should connote both a reprehensible and a commendable business practice.

When a trust fixed prices, before the Sherman law was effectively applied, its chief consideration was public sentiment. Would the newspapers print indignant editorials and satirical cartoons calculated to inflame the public mind? Would legislators be stirred into activity? These considerations were more important than a study of market conditions. On the other hand, the manufacturer who makes a particular brand of soap, which he personally guarantees, or a particular kind of watch to which he gives a name and reputation, must study his market. First of all, he must gage the demand for his trademarked or patented product. Next he must ascertain what competition he is likely to encounter. The extent of his market and the number and character of his competitors very largely determine the price at which he can sell his product. If he fixes his price too high, he automatically cripples himself; for he either limits his sales and thus his income, or permits a rival to undersell him. While the trust that controls a necessity of life may fix prices to suit itself, unless restrained, a single manufacturer, by the very stress of competition, must set his price so low that the public will be induced to buy and that rivals will be unable to undersell at a substantial profit to themselves. A trust may ignore the laws of supply and demand for a time; a single manufacturer must obey them or fail.

Pick up any popular magazine and glance through its advertising pages. You will find a half dozen more or less similar breakfast foods competing with one another, several watchmakers setting forth the merits of their timepieces, at least three large manufacturers of men's clothes who proclaim the attraction of their tailored fabrics, and several fountain pen manufacturers who lay stress on the mechanical excellence of their inventions. You will find that there is not a very wide variation in the prices of competing wares of the same quality. Each manufacturer knows exactly that a retailer must make at least twenty to twenty-five per cent profit on the advertised goods to do business at all; and that the jobber who supplies the retailer must make at least fifteen to twenty per cent for the same reason. He knows that he himself is entitled to about ten or fifteen per cent. Very carefully he studies his manufacturing processes, his methods of buying material, his system of distribution—all for the purpose of assuring to the jobber and the retailer, the profit to which they are justly entitled and of allowing himself a profit large enough to place his business on a firm basis, yet small enough to discourage competition.

It is one thing to fix a price on a well-known article of manufacture and another to maintain it. Before the Supreme Court handed down its decision in the Sanatogen case, it was comparatively easy to maintain a price on a patented article. The lower Federal courts have held that the exclusive right to vend his product, given by law to the patentee, meant the right to fix selling terms and the right to treat a price cutter as a patent infringer. Since the Sherman law did not apply to patented wares, the inventor stood in a very enviable position. But the Sanatogen decision deprives him of his price-fixing privilege and has placed him on exactly the same footing as the vendor of unpatented staple products.

It matters little to a farmer whether the dealer to whom he sells his potatoes retails them at 10 cents or $1.00 a bushel; but it matters a great deal to the patentee of a widely advertised watch whether his selling price is maintained or not. No one knows who planted the potatoes that the corner grocer sells; but everyone knows who made the patented watch that sells for $50. The farmer spends no money in advertising his potatoes or distinguishing them from those of his neighbor. He deals in a staple product. But the watch manufacturer spends perhaps a million dollars a year in coupling his name and honor with his watch, in guaranteeing its workmanship, in driving home its price. His good name and reputation eventually become his principal asset in business. They become a species of property, of such value, however intangible they be, that they can actually be sold. If he loses his name and reputation, either through his own carelessness or the trickery of others, he is in a poor way indeed.

Good will and reputation mean far more now than they did in the past. Before the days of systematic world-wide advertising, a craftsman and his handiwork were known chiefly in his own community. A modern advertiser blazons his name and his pledges in a thousand magazines, and newspapers. Millions know him by reputation, and if his reputation is good, he must inevitably prosper.

One way of robbing a manufacturer of his good name is to offer his wares at less than the price that he has established by much expensive advertising. If a fountain pen that is ordinarily sold at $5, with the minimum profit to the manufacturer and his distributors, is advertised at less than the cost of production by some department store, the public naturally leaps to the conclusion that the manufacturer has been too grasping, in a word that he is not to be trusted. Very few realize that widely advertised articles are thus sold at ridiculously low prices by department stores and mail order houses, solely for the purpose of attracting custom, and that the loss sustained by price cutting is more than compensated for by an exorbitant profit on less-well-known goods.

This policy of trading on the reputation of a well advertised article not only injures the manufacturer, but also the public. How that effect is produced will be explained in the next article of this series.

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Inquiry No. 9301. Wanted the names and addresses of a few concerns who can do machine embroidery according to the design furnished, at reasonable rates.

Inquiry No. 9302. Wanted the address of the manufacturer of the Greenfield flexible armored conductors or cables. This is a double galvanized, spiral conductor or cable.

Inquiry No. 9303. Wanted the name of manufacturer who could make newly patented articles made from 13 to 22 gage sheet aluminum.

Inquiry No. 9304. Wanted the names and addresses of manufacturers of a second hand bag cleaning machine on the order of a carpet cleaning machine.

Inquiry No. 9305. Wanted the name and address of concerns making paper letters and figures.

Inquiry No. 9306. Wanted small hardware and other specialties to be sold in notion and grocery stores. Wanted to buy wholesale.

Inquiry No. 9307. Wanted to buy a machine for honing and stropping safety razor blades on a commercial scale.

Inquiry No. 9308. Wanted woven glass fabric for manufacturing purposes in large quantities. The glass is spun.

Inquiry No. 9309. Wanted to buy small woven tubing of small diameter for use over the temples of spectacles where they go around the ears.

Inquiry No. 9310. Wanted addresses of manufacturers of good selling articles for mail order business catering to the trade of agents.

Inquiry No. 9311. Wanted names and addresses of manufacturers of hatpin heads made of colored glass; also medals of all shapes.

Inquiry No. 9312. Wanted to buy a machine which will pick up a weight the size of a lima bean by vacuum process. Must be able to pick up dust, gravel, etc. Must be operated by electricity and be easily portable.

Inquiry No. 9313. Wanted to buy Leather Heid Horse Shoes used temporarily when shoe cannot be nailed on. In other words a Leather Boot with iron shoe at bottom—strapped over horse's foot.

Inquiry No. 9314. This enquirer is in the market for some patented articles which he could purchase and manufacture with an investment of from $5,000 to $10,000. The name of the party will be supplied to any of our readers on application.

Inquiry No. 9315. Wanted the name and address of a concern manufacturing novelty ink wells.

Inquiry No. 9316. Wanted the names of manufacturers and manufacturers' agents who make patented articles and other useful devices which appeal to the public and which can be used in a mail order business and by canvassers.

An automobile, to give entire satisfaction, must be equipped with an entirely satisfactory electric starter and lighting outfit.

The engineers who design automobiles know this. They realized the demand for some kind of a starting device last season; as a result 1913 is a "self-starter year."

But because they could not foresee the public clamor for starters years ago and because the manufacturers of electrical devices could not foresee it, some engineers thought they were obliged to accept as "standard equipment" on the cars which they designed for 1913, starting and lighting systems which they themselves knew to be still undeveloped.

The Aplco system is not the hastily constructed kind.

Vincent G. Apple designed an electric starting and lighting system in 1900, and it has been carefully developed in the intervening years. He might have put it on the market years ago, had he not determined never to allow any device to leave the plant with the name Aplco upon it until it was perfect in every detail.

The motor car builder's present preference for the Aplco system is not based upon expensive advertising. The selling price of Aplco devices is not made up of items of this nature. It is the materials—the very best to be had anywhere—the workmanship, the "know how," which accounts for Aplco quality and Aplco price.

Mr. Apple's long training in electrical work for motor cars and motor boats has enabled him to make economies in manufacture which his competitors have entirely overlooked, because they lacked that training.

His personal supervision of his corps of engineers has enabled them to work out his ideas and get for the automobile manufacturer and his patrons—the public, the benefit of these economies.

The Aplco Starter

will be the preferred starter on 1914 cars. Here are some of the technical features that commend it to automobile engineers:

The one-unit system

The one-unit system used for the Aplco is the compact, ever-reliable system of the electric manufacturer who knows how to combine these perfectly natural units into one mechanism. The two-unit system can only be regarded by experienced engineers as a make-shift, justified to its manufacturer because of cheaper construction; because he has to rush on the market to meet the big demand.

A 24-volt machine

The repeated tests and study on the starter question that have been going on in the Apple factories for ten years have convinced their corps of engineers that anything less than 24 volts will not give the best service. This added voltage gives additional power for starting purposes and through the controller retains the 6 volts for lighting, ignition and signaling. It gives its charging rate at low car speeds and eliminates too strong a pull on a small battery.

The two wire cable plan

The Aplco systems are built on the two wire cable plan. The return copper cable system eliminates numerous grounds. The one cable system makes almost impossible the dimming of lights, which is one feature of the Aplco two wire plan, and the connecting of dash and tail lights in series so that the driver can determine from the seat whether or not the tail light is burning.

"It never stops starting"

If you are getting ready to buy a 1914 car with the most reliable equipment, you should not be satisfied with a so-called 6 volt starter, nor a one wire system. They have a lot to do with real service from a starting system.

We can help you to bring your present car up to date by installing the Aplco electric lighting system and Aplglow lamps, which penetrate dust and fog. If you don't know the Apple service station in your locality, you should, and we will tell you if you ask.

The Apple Electric Co., 62 Canal St., Dayton, Ohio

Something New and Vastly Better

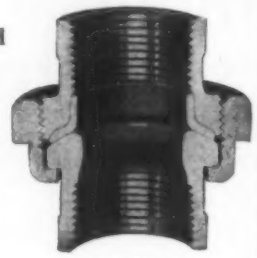
MARK Cold Drawn Sherardized STEEL UNIONS

Drawn from Rolled Steel.

Not a cast iron product.

Then Sherardized to prevent corrosion.

Leak-proof under ANY pressure.



Pat. Applied For.

A union that will not crack as cast unions do.

A union that has a perfect, leakless seat—densified steel against soft brass.

A union that is tapered to fit standard pipe taper, so that all threads are in perfect mesh.

Here, at last, is a pipe union that expands and contracts under alternate heat and cold the same as the pipe, and will not stretch and assume a permanent "set" as malleable unions do.

The Sherardizing process not only coats it with zinc, but actually makes a zinc alloy of the steel. This Sherardizing is done *after* threading, thus protecting the threads from rust and corrosion.

Send for full particulars and prices on this new leakless, rustless, high pressure pipe union.

MARK MANUFACTURING CO.

1903 Dempster Street EVANSTON, ILLINOIS

No camera is so good as the *Graflex* for making pictures of children. Indoors or in the shade snapshots may be made fast enough to secure perfect pictures.

You can photograph on dark days when you use a *Graflex*. This picture was made on a rainy, heavily clouded day in December.

The *Graflex* is best for those who "hunt with a camera."

On clear days, when the sun is shining, the *Graflex* will make pictures in 1-1000th of a second.

GRAFLEX CAMERAS

The GRAFLEX makes better photography possible by eliminating the uncertainties. Focusing scale and "finder" are done away with. With a GRAFLEX you see the image full size of finished picture, up to the instant of exposure right side up. You know to a certainty that the picture is in focus, without having to guess the distance between the camera and subject.

The GRAFLEX Focal Plane Shutter works at any speed from "time" to 1-1000th of a second.

Send for Illustrated Catalog.

FOLMER & SCHWING DIVISION

Eastman Kodak Co.

ROCHESTER, N. Y.

To the South Pole With the Cinematograph

(Concluded from page 561.)

"Of all the scenes cinematographed in the Antarctic, that of Mount Erebus was the most difficult to secure. It would have been folly to drag the heavy apparatus up the volcano's side, but by a stroke of good luck, and through a special telescopic-lens, taken especially to record the volcano, a beautiful clear film was obtained.

"Once when I was securing a film of a pair of young skua-gulls in their nest at very close range I was attacked by the parents so furiously that I was almost laid out. One of the pair swooping down at me, struck me such a blow in the eye with its wing that for an hour or two I suffered most acute pain, and at first feared for the sight of my eye.

"On another occasion, when endeavoring to induce a seal, weighing perhaps a half a ton, to pose for a picture, it suddenly evinced the most determined objections to the proceedings and lunging out at me, it seized hold of my leg, throwing me to the ground. Its teeth went through all of my clothes and drew blood, but I was not hurt, owing to the fact that I fell. Had I not done so, I think my leg would have been broken. This, I believe, is the only instance on record of a Weddell seal ever having bitten a man. However, I certainly invited the trouble, and probably deserved what I got.

"The queer little penguin reminds one of a corpulent old gentleman, dressed in immaculate white waistcoat with satiny top coat. These birds are unable to fly, their wings being merely flappers. Their habits greatly resemble primitive mankind, in that the male selects his mate at certain periods of the year from among countless females, who assemble on the hillside to be inspected by their future lords and masters. The little chaps saunter up and examine the maiden fair with no mean degree of intelligence, and when they decide upon proposing the male sallies off and picks up a stone which he brings and deposits at the feet of her ladyship, emblematic of his ability to provide a nest for their young. She ignores him for some time, until finally he has piled up quite a mound of stones, and then quacks her approval and acceptance, and off they go to establish a bungalow on the hillside."

It is unnecessary to point out the tremendous broadening of interest which is effected by the cinematograph in such an expedition as that of Capt. Scott. Time was when the results of these perilous voyages of discovery were scarcely thought worthy the cost. Nowadays, however, when the pioneer may train the eyes of all the world upon the windows which he is laying here for the first time by his efforts, the risk is justified. He is not storing up experience for himself alone, but for the whole of mankind. His success becomes a matter of paramount interest and importance to everybody, because it is a success in whose benefits we can all now share.

Mr. Ponting, when taxed with the question: "Did you learn the art of photography in your native land?" replied, "No! I learned most of my photography in one of the finest countries on earth—California. I lived there, ranching and mining for about ten years, and there is practically no branch of photography that I have not studied in that land of perpetual sunshine and flowers. My work in Southern California attracted the attention of a big New York publishing house which made me an offer to travel around the world in their interests. This offer was followed by others, and since then (1900) I have been traveling and illustrating everywhere—in thirty different lands. These travels involved every possible kind of photographic work and in every conceivable climate. I have had to take telephotographs of mountains 70 miles distant, and to go to the other extreme, micro-photographs of almost invisible objects. I have worked in the reeking, stifling jungles and swamps of Java and on the plains of Manchuria, where the air

Valuable Books

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¶ A handy, compact, reliable and up-to-date volume for everyday reference, containing a remarkable aggregate of facts, statistics and readable information along industrial, commercial, scientific and mechanical lines of interest to everyone. This volume is a revelation in the nature of facts and figures relating to population, manufactures, commerce, railroads, shipping, mining, agriculture, education, aviation, armies and navies of the world, Panama Canal, post office affairs, telephony, telegraphy and wireless telegraphy, patents and copyrights, chemistry, astronomy and time, meteorology, mechanics, weights and measures, and thousands of other subjects. It will prove invaluable on the desk of the business man as well as the library of the home. No expense or effort has been spared to make it interesting as well as authoritative.

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By ALFRED P. MORGAN. 12 mo., 154 pages, 156 illustrations. Price, $1.00.

¶ A popular, practical and simply worded treatise embracing complete and detailed explanations of the theory and practice of modern radio apparatus and its present-day applications. The author has filled a long-felt want and has succeeded in furnishing a lucid, comprehensive treatise for the operator, both amateur and professional. A close study of its pages will enable one to master all the details of the wireless transmission of messages and to design and construct his own apparatus. Although based on scientific principles, no attempt has been made to give mathematical explanations. It is written so that it can readily be understood by men who are not technical and at the same time is sufficiently comprehensive and practical to be studied advantageously by the ambitious young engineer or experimenter.

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With Hints for the Ocean Voyage, for European Tours, and a Practical Guide to London and Paris.

Compiled and Edited by ALBERT A. HOPKINS. 12 mo., 503 pages, 500 illustrations. Price, flexible cloth, $2.00; full flexible leather, $2.50.

¶ This is an indispensable companion for the European tourist, and contains more miscellaneous information on travel and subjects of interest to travelers than can easily be found in any other form. It is unlike any other guide that has been published and is not intended to take the place of descriptive guides, but as a complement to all of them. It also forms an excellent reference volume for all in any way interested in the ocean and its navigation, as it contains many facts presented in an interesting and readable form, and tells you exactly what you have wanted to know about the trip abroad and the ocean voyage. Excellent maps of Paris and London, a complete automobile roadmap of Europe, and several other maps are included in a pocket at the end of the book.

The Scientific American Cyclopedia of Formulas

Edited by ALBERT A. HOPKINS. Octavo, 1077 pages. 15,000 Receipts. Cloth, $5.00; half morocco, $6.50.

¶ This valuable work is a careful compilation of about 15,000 selected formulas, covering nearly every branch of the useful arts and industries. Never before has such a large collection of valuable formulas, useful to everyone, been offered to the public. Those engaged in any branch of industry will probably find in this volume much that is of practical use in their respective callings. Those in search of salable articles which can be manufactured on a small scale, will find hundreds of most excellent suggestions. It should have a place in every laboratory, factory and home.

Concrete Pottery and Garden Furniture

By RALPH C. DAVISON. 16mo., 196 pages, 140 illustrations. Price, $1.50.

¶ This book describes in detail in a most practical manner the various methods of casting concrete for ornamental and useful purposes. It tells how to make all kinds of concrete vases, ornamental flower pots, concrete pedestals, concrete benches, concrete fences, etc. Full practical instructions are given for constructing and finishing the different kinds of molds, making the wire forms or frames, selecting and mixing the ingredients, covering the wire frames, modeling the cement mortar into form, and casting and finishing the various objects. With the information given in this book, any handy man or novice can make many useful and ornamental objects in cement for the adornment of the home or garden. The information on color work alone is worth many times the cost of the book.

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by the large Cruising Steamers *Victoria Luise*, *Furst Bismarck* and *Meteor*. Leaving Hamburg during the months of July and August. Visiting Iceland, Spitzbergen, North Cape, Norway, Scotland, Orkney and Faroe Island.

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Newest and largest steamship afloat.
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In addition to the well-known features of modern ocean steamers there is a Ritz-Carlton a la carte Restaurant, Ball Room, Grill Room, Private Dining Rooms, Pompeiian Bath, a Swimming Pool and a Gymnasium.

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By Twin-Screw S. S. *Cleveland*, leaving New York January 27th, 1915.

135 days—$900 and up.

Register your engagements now. Good rooms will soon be taken.

Write for beautifully illustrated books stating cruise.

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St. Louis

Trade Mark

is so dry that the skin actually cracks. The most picturesque and altogether interesting section of the world that I have ever visited is the South Polar Continent."

Blasting With Liquid Air

(Concluded from page 564.)

The liquid air is kept ready for each blast hole in a special small flask containing a weighed quantity. These flasks carry at their opening a flexible metal tube with conical point into which the central supply tube is fitted. All that is required for charging then is to lift the back end of the flask, when the liquid air, under the pressure of its own products of vaporization (like mineral water under the pressure of carbonic acid) rises through the metal tube into the supply tube and through this into the cartridge, entering there between the individual particles of the charge, ready at the very moment explosion is started by electric ignition, to combine with the components of the cartridge in an explosion of terrific violence. The completion of the charge is readily ascertained by the cessation of the fizzing noise under which part of the liquid air escapes from the blast hole as a white fume.

This process thus eliminates all the difficulties experienced in early attempts to use liquid air as an explosive. Being readily prepared by a cheap process at the place of consumption, in fact, in the very gallery where it is to be used, it does away with the lamentable accidents inseparable from the transport and storing of dynamite above or below ground. Furthermore, there is no possibility of the explosive's being stolen, e. g., for unlawful purposes, nor is the manufacture of the explosive itself connected with any danger, while the presence of considerable amounts of oxygen in the form of liquid air is a valuable addition to the salvage arrangements of the mine.

By using the cheap fuel available in coal mines, the operation of a liquefaction plant will be cheapened sufficiently for liquid air to compete successfully with the ordinary explosives.

A New Road Material

WITH a view of obtaining a road surface which will give a better resistance to automobile traffic, experiments are being made again in France with a roadbed material consisting of an intimate mixture of "iron straw" or iron in the shape of a wiry or fibrous mass such as is commonly used for cleaning and scraping purposes in this country, together with cement mortar and sand. Such material is called "ferro-cement," and it appears that tests as to its fitness for road surfaces are giving good results. But the iron is not the usual kind found in commerce, but is prepared specially for the purpose by suitable machines of appropriate design. It is claimed that the resulting material will not be an over-expensive one.

A Septuagenarian Arctic Explorer

IT is reported that Capt. Peter Bayne, who in 1868 was attached as a seaman to Capt. C. F. Hall's expedition in search of the remains of Sir John Franklin and his party, and who is probably the last survivor of that enterprise, has purchased the old arctic schooner "Duxbury" at Seattle, and will head an expedition to Victoria Land, sailing next June. Capt. Bayne is 69 years old.

Coal in Nigeria

EXTENSIVE deposits of coal have been discovered at Udi, Southern Nigeria, and a survey is being made for a railway to connect this coal field with the river port of Onitsha. Analyses carried out at the Imperial Institute in London indicate that the Nigerian product has two thirds the value of the best Welsh coal. This discovery is likely to contribute much toward developing the resources of Nigeria.

Correct automobile lubrication is a serious problem. But its fundamentals are simple. We will cover them in a plain question-and-answer form.

Question: What moves your car?

Answer: Power.

Question: What determines your power?

Answer: Your motor, your fuel and your lubricant. If any one of these factors falls short in full efficiency, you receive less than full power. The greater part of the power lost is taken up by friction—wear on the moving parts.

Question: What will give you the most efficient lubrication?

Answer: An oil of the highest lubricating *quality* whose "*body*," or thickness, is best suited to the feed requirements of your motor.

Question: Suppose you use oil of lower lubricating *quality* or of less correct "*body*." What are the penalties?

Answer: Many. Among them are:

(1) Escape of the explosion past the piston rings and loss of compression. (2) Unlubricated cylinder walls at the upper end of the piston stroke. (3) Imperfect lubrication of many of the bearings. (4) Excess carbon deposit. (Due to the oil working too freely past the piston rings and burning in the combustion chamber.) (5) Excessive oil and fuel consumption. (6) Worn wrist pins. (7) Rapid and unnecessary deterioration of your motor. (8) Loose bearings. (9) Noisy operation.

Question: How can you determine the correct oil for your car?

Answer: By consulting the lubricating chart—printed in part on the right.

Question: What assures the reliability of this chart?

Answer: The chart is the result of the most far-reaching and most thorough study of automobile lubrication that has ever been undertaken.

It was prepared by a company whose authority on scientific lubrication is recognized throughout the world—the Vacuum Oil Company.

It was prepared after a careful analysis of the motor of each make and each model of American and foreign car.

The superior efficiency of the oils specified has been thoroughly proven by practical tests.

If you use oil of lower lubricating ***quality*** *or of less-correct* ***"body"*** *than that specified for your car, your motor faces unnecessary friction, loss of power, and ultimate serious damage.*

In buying Gargoyle Mobiloils from dealers it is safest to purchase a full barrel, half-barrel, or a **sealed** five-gallon or one-gallon can.

Look for the name and the red Gargoyle on the container.

A booklet, containing our complete lubricating chart, together with points on lubrication, will be mailed on request.

Explanation: In the schedule, the letter opposite the car indicates the grade of Gargoyle Mobiloil that should be used. For example: "A" means "Gargoyle Mobiloil A." "Arc." means "Gargoyle Mobiloil Arctic." For oil electric vehicles use Gargoyle Mobiloil A. The recommendations cover both pleasure and commercial vehicles unless otherwise noted.

MODEL OF CARS	1909 Summer	1909 Winter	1910 Summer	1910 Winter	1911 Summer	1911 Winter	1912 Summer	1912 Winter
Abbott Detroit	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Akron	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
American	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Apperson	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Autocar (2 cyl.)	A	Arc.	A	Arc.	A	Arc.	A	Arc.
" (4 cyl.)	A	E	A	E	A	Arc.		
Avery			A	E	A	E	A	A
Benz	A	A	A	A	A	A	A	A
Brush (2 cyl.)	A	A	A	A	A	A	A	A
" (4 cyl.)	A	Arc.	Arc.	A	Arc.	A	Arc.	A
Cadillac (1 cyl.)	B	A						
" (4 cyl.)	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Carhartt	A	A	A	E	A	E	A	E
" Com'l.	A	A	A	E	A	Arc.	A	Arc.
Case					A	A	Arc.	Arc.
Chalmers	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Chase	B	B	B	B	B	B	B	B
Cole			Arc.	Arc.	A	Arc.	Arc.	Arc.
Columbia	A	E	E	E	A	A	A	A
" "Knight"							A	A
Couple Gear	A	A	A	A	A	A	Arc.	Arc.
Daimler	A	E	A	E	A	E	A	A
" "Knight"					A	A	A	A
Darrach	A	E	A	E	A	E	Arc.	Arc.
De Dion	B	A	R	E	B	A	B	A
Delaunay-Belleville	B	A	B	A	B	A	B	A
Elmore	A	A	Arc.	Arc.	Arc.	Arc.	Arc.	
E. M. F.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	
Fiat	B	A	A	B	A	A	B	A
Flanders			E	E	E	Arc.	Arc.	
" (6 cyl.)							Arc.	Arc.
Ford	E	E	A	Arc.	E	E	E	E
Franklin	B	E	B	Arc.	A	Arc.	A	Arc.
" Com'l.	B	A	B	A	B	A	A	Arc.
G. M. C.					Arc.	Arc.	A	Arc.
Grabam				A	Arc.	A	Arc.	Arc.
Graham-Logan	A	Arc.	A	Arc.				
Haverhill	A	A	Arc.	A	A	Arc.	A	Arc.
Hewitt (2 cyl.)	A	A	A	A	Arc.			
" (4 cyl.)	A	E	A	E	A	Arc.	E	E
Hudson			Arc.	Arc.	A	Arc.	A	Arc.
Hupmobile "32"	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" "20"							Arc.	Arc.
I. H. C. (air)							B	A
" (water)							A	A
International	B	A	B	A	B	B	B	A
Interstate	A	E	A	E	A	Arc.	A	Arc.
Ionia	A	A	A	A	A	A	A	A
Italia	A	A	A	A	A	A	A	A
Jackson (2 cyl.)	A	A	B	A	B	Arc.	B	Arc.
" (4 cyl.)	A	E	A	Arc.	A	Arc.	A	Arc.
Kelly					Arc.	Arc.	Arc.	Arc.
Kelly Springfield							Arc.	Arc.
Kissel-Kar	A	E	A	E	A	Arc.	A	Arc.
" Com'l.					Arc.	Arc.	Arc.	Arc.
Kline Kar			Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Knox	B	A	B	A	B	A	B	A
Krit			A	A	A	A	A	A
Lancia	B	A	B	A	B	Arc.	B	Arc.
Locomobile	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Lozier	A	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Mack	A	E	A	E	A	E	E	E
Marion	A	E	A	E	A	E	A	Arc.
Marmon	Arc.	Arc.	A	E	A	Arc.	A	Arc.
Matheson	Arc.	Arc.	Arc.	Arc.	A	A	Arc.	A
Maxwell (2 cyl.)	E	E	E	E	E	E	E	E
" (4 cyl.)	E	E	E	E	Arc.	Arc.	Arc.	Arc.
" (6 cyl.)							Arc.	Arc.
Mercedes	A	E	A	E	A	E	A	E
" "Knight"					A	A	A	A
Mercer			A	Arc.	A	Arc.	A	Arc.
Michigan			Arc.	Arc.	A	Arc.	A	Arc.
Minerva "Knight"					A	A	A	A
Mitchell	A	A	Arc.	Arc.	A	Arc.	A	Arc.
Moon	A	E	A	E	Arc.	Arc.	Arc.	Arc.
National	A	Arc.	A	A	A	A	A	A
Oakland	A	E	A	E	A	Arc.	A	Arc.
Oldsmobile	A	E	A	E	A	Arc.	A	Arc.
Overland	A	E	A	E	Arc.	Arc.	Arc.	Arc.
Packard	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Paige Detroit			E	E	A	Arc.	A	E
Panhard	A	E	A	E	A	E	A	Arc.
" "Knight"					A	A	A	A
Pathfinder							A	Arc.
Peerless	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Pierce Arrow	A	Arc.	Arc.	Arc.	A	Arc.	A	Arc.
" Com'l.				Arc.	Arc.	Arc.	Arc.	Arc.
Pope Hartford	A	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Premier	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Pullman	A	E	A	E	A	Arc.	Arc.	Arc.
Rambler	A	A	A	A	A	Arc.	Arc.	Arc.
Rapid	A	A	A	A	Arc.	Arc.	Arc.	
Rayfield					A	A	A	A
Regal	A	E	A	E	A	Arc.	Arc.	Arc.
Renault	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Reo	A	A	A	E	A	Arc.	A	Arc.
R. G. V.				B	Arc.	B	Arc.	Arc.
Selden	A	E	A	E	A	E	Arc.	Arc.
Service					A	A	Arc.	A
Singlet	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Speedwell	A	Arc.	Arc.	Arc.	A	Arc.	A	Arc.
" "Mead"							A	Arc.
Stanley	D	D	D	D	D	D	D	D
Stearns	A	A	Arc.	Arc.	A	Arc.	A	Arc.
" "Knight"							A	A
Stevens Duryea	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Studebaker-Dayton	E	E	Arc.	Arc.	A	A	A	A
" "Knight"							A	A
Studebaker	A	B	E	E	A	Arc.	Arc.	A
Stutz					Arc.	Arc.	Arc.	Arc.
Thomas	E	E	E	E	E	E	E	E
Walter	A	B	A	E	Arc.	Arc.	Arc.	Arc.
Warren Detroit			Arc.	Arc.	A	A	A	A
White (Gas)			Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" (Steam)	D	D	D	D	D	D	D	D
Winton	E	E	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.

GARGOYLE

Mobiloil

A grade for each type of motor

The various grades, refined and filtered to remove free carbon, are: **Gargoyle Mobiloil "A", Gargoyle Mobiloil "B", Gargoyle Mobiloil "D", Gargoyle Mobiloil "E", Gargoyle Mobiloil "Arctic."**

They are put up in 1 and 5 gallon ***sealed cans,*** in half-barrels and barrels. ***All are branded with the Gargoyle, which is our mark of manufacture.*** They can be secured from all reliable garages, automobile supply stores, and others who supply lubricants.

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Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

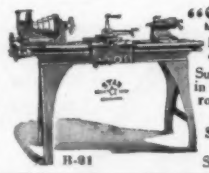
(12815) R. A. M. asks: Can you tell me whether the moon revolves on its axis or not? A. The moon always presents the same side toward the earth, and so does not rotate as we see it. But it revolves around the sun with the earth, and in so doing presents every side to the sun each month. So the astronomers say that it turns on its axis once in a month. The sun rises and sets on each part of the moon once a month.

(12816) L. A. A. says: There is a controversy among a number of our villagers in regard to a ball after it leaves the gun; some claiming the ball after leaving the muzzle rises slightly from a dead level with the barrel, while others claim it begins to fall from the time it leaves the muzzle of the gun. Will you kindly settle the question? A. We would refer you to SCIENTIFIC AMERICAN, Nos. 6 and 7 of vol. 107, for an article on the path of projectiles. If you have not these copies in your file, we will forward them postpaid upon receipt of 20 cents. It is very possible that in particular instances there is a rise in the trajectory of a bullet above the line of fire. This is believed to be caused by what is termed "unbalanced bullets." Despite the extreme care taken in casting the small lead bullets, the center of gravity of the bullet is often to one side of the axis. The twist of the bore causes the bullet to revolve about its axis. When the center of gravity of the bullet is "off center," this twist causes it to revolve in a spiral. Upon leaving the bore, the bullet flies off at a tangent to the spiral. If the center of gravity of the bullet were to be at the upper side of the spiral at the instant it left the bore, it is very possible that the bullet would rise slightly above the line of fire. As stated above, this would hold true only in particular instances, and is due to an eccentricity in the bullet rather than to a law of ballistics. If the lead bullet were perfect, it would be below the line of fire at all points on its trajectory.

(12817) J. H. M. asks: 1. I am making a chemical laboratory balance according to plans in your SUPPLEMENT, and I wish to graduate the beam into 40 divisions from center to end, and wish to ask you what each division will read, using a rider weighing 1, 2, 5 or 10 milligramms? A. If you graduate the beam of your balance into 40 divisions, each division will represent 140 of the weight of any rider you may use. We have never seen a balance beam divided in this way. They are always divided into 50 parts and the value of each division is then 1/50 of the rider; and if the rider is placed in the middle of a space between two divisions, the value will be 1/100 of the weight of the rider. This is easily a metric division, but 1/40 will not be so easily calculated. The riders upon chemical balances and all the laboratory balances in common use have a weight of 10 milligrammes. One rider only is employed. This enables you to weigh 0.1 milligramme, and this is as far as you can go with an ordinary analytical process. The balance will not be sensitive to a smaller weight than that. It is not desirable to have weights less than the sensitiveness of the balance allows. Thus, you cannot use gramme weights upon grocers' scales, nor ounce weights upon hay scales. 2. Could denatured alcohol be used for making perfumes? A. If alcohol is denatured with wood alcohol, the odor will not be agreeable, and will unfit it for use in perfumery.

(12818) J. T. asks: In your issue of May 10th, 1913, there appeared an article on benzol as a corrector of heavy oils for use in oil engines. Could we use an oil as heavy as a tar oil, if we combined it with benzol, or would it need a special vaporizer to vaporize the oil? Or would it be more economical to mix benzol with our fuel oil? If so, where can it be obtained? A. You are doubtless quite familiar with benzol under its more common name benzine. It will dissolve, and make more fluid, most of the other and heavier oils which come off in the distillation of petroleum at a temperature higher than its boiling point. It can be obtained at almost every paint store, and gasoline does not differ much from it. Gasoline is often furnished when benzine is called for. Gasoline, naphtha, and benzine differ in their boiling points. In distilling petroleum, that which comes off from 70 deg. to 90 deg. Cent. is gasoline; from 80 deg. to 120 deg. Cent., naphtha; from 120 deg. to 150 deg. Cent., benzine; from 150 deg. to 300 deg. Cent., kerosene.

(12819) F. H. P. asks: Please inform me through your columns of the numbers of the SCIENTIFIC AMERICAN OR SUPLEMENT in which I may find an explanation of the work of the spectroscope. I wish an extended discussion of the instrument and its various uses. A. We can send you twenty valuable papers upon the spectroscope and its uses for $2, and send you our Supplement Catalogue, in which on pages 26 and 70 you will find list of the articles. We would suggest also Young's "Sun," price $2; and Abbott's "Sun," price $2.50. In both these books the subject receives full notice.



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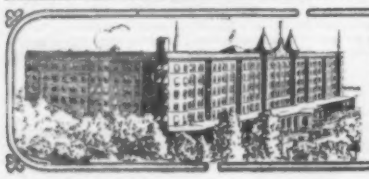

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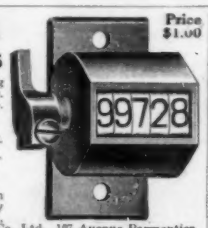

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THE PRICE OF INEFFICIENCY. By Frank Koester. New York: The Sturgis & Walton Company, 1913. Price, $2 net.

Mr. Koester's book assumes rather a cocksure attitude. Thus, statements such as that which occurs on page 12, to the effect that "no Catholic can become President of the United States, no Jew, no atheist, no Southerner, and no philosopher, however great," finds its counterpart in similar assertions. We have a Southerner now in the presidential chair. But apart from a tendency to overstate his case, there can be no doubt that Mr. Koester has performed a really valuable service in pointing out wherein we are nationally inefficient, and wherein we may improve ourselves. A thorough knowledge of German conditions enables him to present many an instructive contrast with corresponding American conditions, naturally much to our own disadvantage. Mr. Koester is a destructive rather than a constructive critic. He is better at picking out flaws in our social organism rather than at indicating how they may be eradicated. A very large part of the book is quoted matter, but it comes from excellent sources and helps along his cause.

THE PANAMA GUIDE. By John O. Collins, Mount Hope, Canal Zone. I. C. C. Press, 1912.

This is an excellent guide book written primarily for the tourist, but also highly instructive to the general reader who is seeking information in a compact form on the Panama Canal and its construction.

THE NEW HOUSEKEEPING. Efficiency Studies in Home Management. By Christine E. Frederick. Garden City and New York: Doubleday, Page & Co., 1913.

Mrs. Frederick's book is a republication of a series of articles that originally appeared in the *Ladies' Home Journal*. In it we find a very praiseworthy attempt to apply to housekeeping the efficiency principles of Mr. Harrington Emerson and Mr. Frederick W. Taylor. The thoroughly practical character of Mrs. Frederick's book, the intelligence which she displays in preventing wastes and in saving time and motion, make her advice extremely helpful even to the most experienced housekeeper. Now that the requirements of the housekeeper are thus lucidly set forth, it behooves the architect to profit by Mrs. Frederick's investigations; for at the root of all efficiency, whether it relates to a household or a manufactory, is a well-designed plant. Thus far the architect has provided a housekeeping plant which meets only the more obvious requirements—gas stoves, running water, ice-boxes and pantries. What is now needed is a house designed according to efficiency principles so far as its internal economy is concerned. In that work Mrs. Frederick's book will prove of great help.

LA MER. Fascicule 21 to 25. Paris: Librairie Larousse, 1913.

In these new installments of the excellent "La Mer" of Larousse we find popularly written yet accurate articles on yachting, handling a sailing ship, navigation, harbors and ports, the planning and administration of a port, maritime canals, etc. As a piece of printing and illustration this book of Larousse's may be regarded as a model.

WIRELESS TELEGRAPHY, WIRELESS TELEMECHANICS, AND WIRELESS TELEPHONY IN POPULAR PRESENTATION. By A. Monier. With a Preface by Prof. E. Branly. D. Dunod and E. Pinet, Paris: 1913. 242 pp. Price, 2 francs 50 centimes.

Wireless telegraphy owes a great deal to French scientific genius. We may easily forgive the author his patriotic pride, which induces him to claim for France the chief glory of the development of wireless telegraphy. Perhaps an impartial judge would be inclined to give chief credit in this matter to Maxwell and Hertz. The fact remains that the first practical detector for wireless waves, the so-called coherer was devised by Branly. And the French are justly proud both of this and many other important contributions which they have made toward developing wireless telegraphy. The book before us is a most excellent popular presentation of the main facts relating to the theory and practice of wireless telegraphy. Of particular interest are the chapters on tele-mechanics: that is to say, the operation of various mechanical devices from a distance by the aid of electric waves. Very valuable too is the account of the wireless station installed upon the Eiffel tower. But the book is full of excellent material. There is a table of contents, but no index, a slight defect which may be excused in the case of so small a work, particularly as the table of contents is very complete.

DER BLUEHENDE SEE. Von Dr. Adolph Koelsch. Stuttgart: Kosmos Gesellschaft der Naturfreunde, 1913.

This is a well-written popular account of freshwater flora. It is another desirable addition to the excellent inexpensive and popularly worded monographs issued by the Kosmos Society.

WOMEN AS WORLD BUILDERS. Studies in Modern Feminism. By Floyd Dell. Chicago: Forbes & Co., 1913. 12mo.; 104 pp. Price, 75 cents.

In spite of the author's protestations of sincerity, the motives and meanings he ascribes to the feminist movement are fantastic and overdrawn. This, however, does not prevent his narrative from being authentic and intense.

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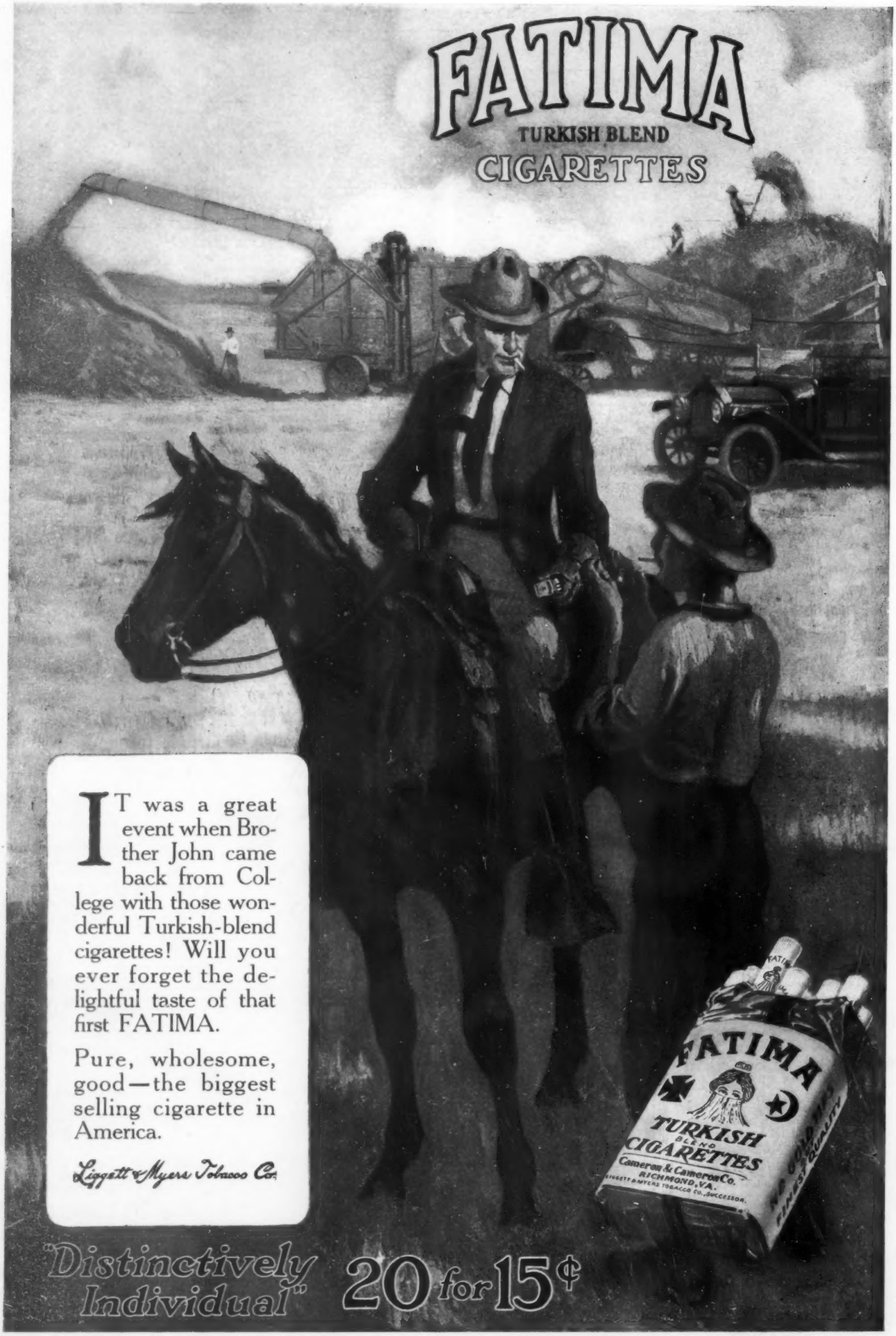
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